MAY 8 1922

Electrical World

McGraw-Hill Company, Inc. New York, May 6, 1922 Twenty-five Cents a Copy

Type WG

Handsomely decorated ceiling band of heavy-gauge brass finished in old gold. Reflector plane of Armco Iron, porcelain enameled; ornamental design on outer edge in old ivory. Special white glass bowl, beautifully etched.

Efficient — Economical — Beautiful

The high efficiency of Brascolite is due to its scientific principle of *diffusion plus reflection* at the source of light.

Eighty per cent of the light rays—softened by diffusion—are reflected to angles below 90 degrees, where they are made useful for economical illumination.

Its high efficiency, with low cost of installation and maintenance, has made Brascolite the largest selling lighting fixture in the world.

This beautiful type WG is but one of a wide variety of designs, all incorporating the Brascolite principle of scientific illumination. Write for descriptive booklets.

Our Designing and Engineering Departments are at your service for any special requirements, at any time, without obligation.

You are cordially invited to visit our Period Display Rooms, which will be opened May 1st, 1922, for the demonstration of our varied line of fixtures in appropriate surroundings.

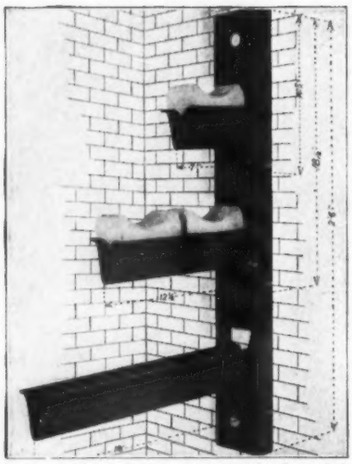
THE BRASCOLITE COMPANY, ST. LOUIS, U. S. A.
Division of the St. Louis Brass Manufacturing Company
BRANCH OFFICES: (*Sales and Service*)

Atlanta Boston Cincinnati Chicago Omaha Detroit Los Angeles
Minneapolis New Orleans New York Oklahoma City Philadelphia

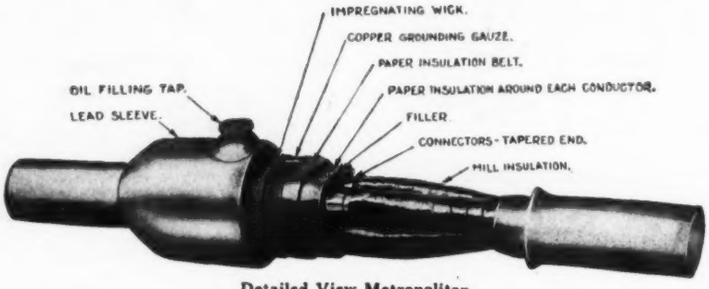
BRASCOLITE

PATENTED AND TRADE MARK REGISTERED

The Ideal Light for Every Purpose



Metropolitan Cable Rack with Porcelain Insulators



Detailed View Metropolitan Oil-Filled Cable Joint

How About Spring Distribution Requirements?

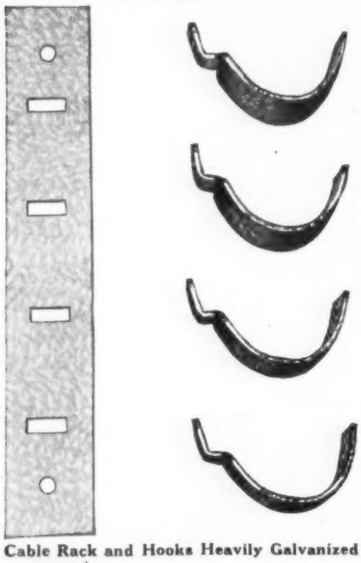
Now is the time to check up your cable needs — racks, junction boxes — supports — measuring devices, etc.

Get our prices and the recommendations of our engineers before placing your order. Let's co-operate.

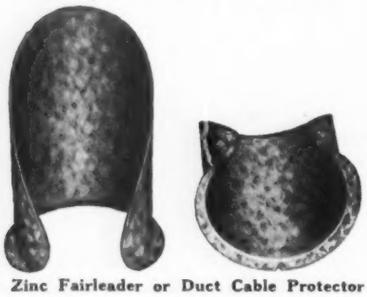
Method of measuring current in cable with No. 70 ammeter (side view)

Metropolitan Device Corp.

Brooklyn, N. Y.



Cable Rack and Hooks Heavily Galvanized



Zinc Fairleader or Duct Cable Protector

Metropolitan Six Stub Subway Junction Box

METROPOLITAN DEVICE CORPORATION.
1250 Atlantic Ave., Brooklyn, N. Y.

Gentlemen: Please send me on 30 days' approval for trial the following:.....If satisfactory I will send you order covering material sent.

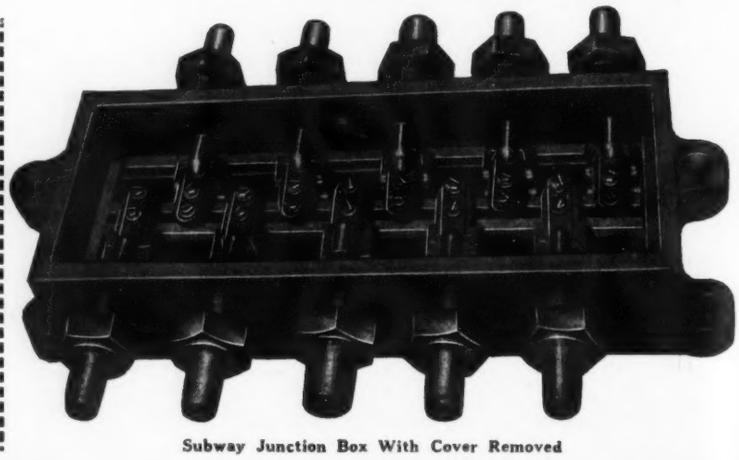
Name of Company.....

By .....

Title .....

Address .....

Date .....



Subway Junction Box With Cover Removed

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.
W. H. ONKEN, JR., and D. H. BRAYMER, Editors

EARL E. WHITEHORNE, Commercial Editor
S. B. WILLIAMS, Assistant Managing Editor
A. M. PERRY, Engineering Editor
J. C. MARTIN, Western Editor
G. E. ARMSTRONG, Pacific Coast Editor
H. S. KNOWLTON, New England Editor
Associate Editors: T. P. KINDIG R. M. DAVIS H. H. STINSON R. L. SHEPHERD F. C. WELLS

Volume 79 New York, Saturday, May 6, 1922 *Number* 18

Which Kind of Business?

WHILE we are all responding and expanding to the joyful knowledge that good times have come again, there is a question to be asked. The industry is organizing for a protracted crusade to *"Electrify America!"* We realize that at last we can go forth and seek and find more business—better business. But—which *kind* of business does this mean?

It is all right to say "more business." It is wise to stress the point that this new business should be "better." But, frankly, what is it we mean by "better business"? Do we really know, we central-station men and manufacturers, jobbers and contractor-dealers?

AS EACH central-station executive takes up in his own town the vital local work of the great national movement for business development he must decide what he is going to do. The first step with most companies will be the rebuilding of an adequate commercial department, manned with expert salesmen. But what next?

Will the main effort be applied to residence business, or commercial lighting, or small power—to appliance merchandising, lighting used for advertising purposes, such as electric signs, store windows, outlining and floodlighting, or to large power load? And how much shall they concentrate on the development of industrial heating, electric vehicles and domestic ranges? In short, what is the value of each kind of business—rated by the cost of sales effort, by the profit from the energy to be consumed and by the value of the influence on public relations? Do we know?

And what of the jobber and the manufacturer—both major factors in this great creative plan? Both have some very pressing economic problems that will help or hinder as they are well solved or not. The whole existing system of distribution is under scrutiny right now, and at the heart of it is the same question: *Which kind of business?* Shall the jobber sell appliances or shall he not? And should the manufacturer reduce waste by refusing to make up and sell unneeded or unpopular types and styles?

OPEN the door to business by all means, but in creating markets let us work with an intelligent regard for the net as well as an ambition to roll up the gross in total sales. We are embarking on a broad commercial venture, a co-ordinated movement to electrify all homes and industries—no less. We must have care that we produce not busy-ness alone, but a balanced service and a high degree of profit in return.

Before he undertakes to work the plan of this great enterprise each man will do well first to plan his work in it. Make sure—which kind of business.

Frank Wheatcroft Frueauff

A pioneer in public relations who is one of the foremost of public utility executives.

IF ONE were to ask what more than anything else is occupying the attention of electric light and power company executives, the answer would probably be public relations. When the public understands it becomes sympathetic and not only is willing but demands that its local public service company shall get fair treatment. Good public relations, however, is not a new idea—it is merely that its value is becoming more widely appreciated One of the earliest to recognize that people respond to human kindness even when it comes from a public utility employee was Frank W. Frueauff, now the "& Company" in Henry L. Doherty & Company. Mr. Frueauff is a director in more public utility properties probably than any other individual. He has never forgotten the lesson he learned as a young man in Denver and as a result has instilled into the minds of those operating the properties under his guidance the value of a smile, individual recognition and honest dealings.

It was at Columbia, Pa., that he was born in 1874 and at Leadville, Col., that he spent his boyhood days. At seventeen he had finished high school, and at once he started work with the electric light company at Denver as a meter reader and lamp clerk. His first advance was to office collector, where he met customers who came to pay their bills. Here he began applying his theory of public relations. He memorized the names of customers, because as he said: "I had figured out that if I got to know all these people and if they got to know me, they would be a little more tractable whenever they came in with a kick." And they were. In fact, this ability of his to straighten out ticklish matters with customers so attracted the attention of his superiors that promotion was steady. He was elected secretary of the company in 1899, vice-president and general manager eight years later and president in 1913. In the meantime he became a partner in the organization of Henry L. Doherty & Company. The lessons learned at Denver were used elsewhere as properties, mostly rundown from mismanagement, were acquired. While Mr. Doherty was seeing that the properties were put in first-class operating condition Mr. Frueauff was bringing the company and its public together on a basis of mutual respect and confidence. From the top of the organization down the employees were taught that fair and considerate treatment must be accorded every customer. As the activities of the partnership expanded this work has naturally been delegated to the local managers, but the inspiration nevertheless still comes from Mr. Frueauff.

His home is now in New York, where, in addition to having a reputation as a public utility executive of first rank, he is recognized as one of the foremost financiers of the day. He is a firm believer in financing by customer ownership securities and in this way finds he is able to attract enormous amounts of new capital.

Unusual energy and activity have always characterized Mr. Frueauff. In addition to the demands made on him by his business he has found time to devote to association activities. He has been president of the National Commercial Gas Association, National Electric Light Association and Colorado Light, Power and Railway Association.

Editorial Comment

Electrical World, May 6, 1922

Volume 79 Number 18

The Forthcoming Convention at Atlantic City

WITHIN a very short time Atlantic City will contain one of the largest gatherings of electrical men ever drawn together in this country. Normally very interesting and instructive, the convention of the National Electric Light Association promises to be particularly so this year. Aside from matters of technical and engineering interest which contribute to improved service or service at less cost, questions of broad public importance will be discussed. One whole day has been set aside for serious and vital thought on improving and reviving business, and as a result of this it is expected that great impetus will be given to a nation-wide co-operative campaign for better business under electrical auspices. In the present stage of the nation's affairs such a movement is commendable, and if all branches of the industry pull together, it ought to be effective as well. On questions of public relations, regulation and kindred managerial topics also the program is a full one and justly warrants the attendance anticipated. No phase of the electric light and power business appears to be left untouched, and with the ever-increasing interest shown in the affairs of the N. E. L. A. the convention ought to be a record breaker.

Confusing Decision on Going Value

THE United States Supreme Court in its decision of April 10 in the Galveston case eliminated development costs—*i.e.*, "the cost of developing an operating railway system into a financially successful concern"—as an element to be included for the purpose of determining whether the rates of a public utility are confiscatory. Unless modified or amplified, this decision will seriously affect the development of water powers and other utility enterprises in virgin territory where the construction period is followed by a period of building up the market during which revenues are not sufficient in many cases to pay expenses of operation, much less any return on the capital invested.

Going value, as representing the enhanced value of an assembled and established plant doing business and earning money over one not thus advanced, has long been recognized by the courts of this country, from the United States Supreme Court down, and by public service commissions, as a property right to be considered in determining the base value on which the owner has a right to earn a fair return. The difficulty has been to find some adequate yardstick with which to measure this property right. Recently certain commissions have adopted and followed the so-called "Wisconsin" theory of measuring it by the losses sustained during the formative developmental period in building the property to a going, paying basis.

While some ambiguity of language and confusion of terms are found in the Galveston decision which might lead one to believe that the court excluded going value as that term is commonly understood from consideration in a confiscation case, it is probable that what the court did do or intend to do was to exclude developmental cost or early losses as a measure of the going value, and not to exclude going value itself. If development of public utilities is to go forward in the public interest, early losses or costs must be taken into account in one way or another, whatever the term applied, and it is to be hoped that the United States Supreme Court will have the opportunity at an early date and in a clear-cut case to make its position clear on those points treated of generally and rather indefinitely in the Galveston case.

Striking Advantages of Interconnection

FOR years the ELECTRICAL WORLD has counseled the interconnection of contingent generating systems with a view to maximum economy and reliability of production. Probably nowhere else in the country has interconnection been practiced on so large a scale as at Niagara Falls, and just recently its advantages have been demonstrated in a most dramatic fashion. Owing to a series of accidents in two of the stations on the system of the Hydro-Electric Power Commission of Ontario it was suddenly deprived of more than 150,000 hp. Owing, however, to the extensive interconnections between all of the hydro-electric systems at Niagara Falls this load was quickly taken up by the Toronto Power Company and the Niagara Falls Power Company. It is a pleasure to note that, although the latter utility is under private control and management, it has always co-operated in a broad-gaged and enlightened manner with the governmentally owned system. The power companies at least have learned the advantages of reciprocity, even though their respective governments do not practice it. Were it not for the interconnections at Niagara, electric service in many of the municipalities of Ontario at present would be greatly curtailed. The fact that normal conditions prevail justifies the practice of interconnection, and when the economies are taken into consideration the arrangement is shown to be doubly profitable.

Keep Bins Well Stocked with Coal

ALTHOUGH more than five weeks have elapsed since the coal miners went on strike, we have yet to hear of an electric public utility which has been handicapped through lack of coal. Indeed, the demand for coal has been so small that many non-union mines which would normally be in operation are shut down for want of orders. Under such circumstances one need not refrain from buying coal for immediate consumption or for storage if it is obtainable at a reasonable price. There

is no necessity for purchasing more than is needed, especially if lower prices are expected; but if reserves are permitted to run too low, it may be difficult to replenish them quickly when the pinch comes. Just now coal production ought to be encouraged, provided, of course, that the price is right. The electrical industry should avoid, if possible, bringing on any crisis in coal supply. A good load factor is as essential to a coal mine and a railroad as it is to an electric light plant, and a steady movement of coal to market is most desirable. The fact that the public has not been inconvenienced in its supply of electricity during the coal strike speaks well for the public utilities. There is no telling how long the strike will last, however, and as a matter of precaution coal stocks should be replenished gradually and discreetly.

Important Steps Made in Studying Cold Light

ALMOST simultaneously within the past few days there have appeared two independent announcements of important progress made toward the attainment of a practicable source of light of the class commonly spoken of as "cold light," in which the evolution of light is not dependent upon temperature. Both of these announcements bear the earmarks of careful work and of conservative claims. The first comes from one of our university laboratories and describes the work of Professor Harvey in studying the light-giving powers of insects and animalcules. He has found that a certain small shellfish found in Japanese waters can be stimulated to something approaching its original light-giving powers by chemical means even after long preservation. The principal feature of his work, however, seems to lie in the process he has discovered whereby the oxidation which accompanies the giving of light is made reversible and consequently the light-giving properties continue. No claim is made as yet that the principle may be incorporated into a commercial lighting source, but from present accounts it appears as though an important step has been made toward an understanding of the processes that underlie these natural sources of light.

The second announcement referred to describes an application of the principle of gaseous conduction to a lighting source suitable for ordinary commercial circuits. This has been a favorite field for experiment, and from time to time there have appeared on the market several types of tube lighting in which the passage of current through a rarefied gas causes the latter to emit light. The phenomenon is the same as that observed in Geissler tubes, in which ionization by collision of the particles of the gas is accompanied by the evolution of light. Carbon dioxide, neon, hydrogen and mercury vapor are among the gases which have been used. In all lamps of this type which have so far appeared high voltage has been necessary, thus placing a serious limitation upon their utility. Details as to the latest member of the group are as yet quite meager, but it is stated that it will operate on a 240-volt circuit, requires very little energy, and that it produces a pinkish-red light.

In addition to the matter of voltage a further difficulty found with light sources of this character in the past has been their low luminous output per unit of service. If the new lamp can even begin to approximate the incandescent lamp on this basis, its development will mark the beginning of a new epoch in lighting. Further information as to this lamp will be awaited with great interest.

The Educational Influence of Radio

TEN years from now men will look back upon these early days of radio and ask: "What is the greatest service that wireless broadcasting has rendered to the electrical industry?" And the answer probably will be that its educational influence has been more valuable by far than all the profits of the great trade which it brought into being. For radio is interesting the people in the technical aspects of electricity and building up a degree of popular understanding which has never been approached before.

Twenty years ago the average man or woman had no knowledge of internal-combustion engines and machinery, but the motor car has introduced this engineering problem into the family circle and made it a matter of common concern, until today we hear men talk of carburetors, lubrication and differentials as their fathers talked of whiffletrees and hames. What the motor car has done to educate this generation in the operation of gasoline engines radio is now proceeding to repeat in familiarizing the public with the principles and manifestations of electricity.

Up to now electricity has been looked upon as a mystery impenetrable by ordinary minds. People have simply refused to *try* to understand it, and therefore, though they have willingly used the comforts which it offers them, they have made little progress in a knowledge of this subject, which is so vital to the modern scheme of living. Yet already radio has lured these heretofore indifferent individuals deep into the lore of wave lengths, frequencies and voltages. They are studying the audion tube and working out the underlying principles that soon will make this subject of electricity as real to them as the driving of an automobile.

A Widening Interest in Physical Research

JUDGING from the papers presented before the recent meeting of the American Physical Society in Washington, D. C., there is a spreading interest in physical research among large organizations in the field of electrical industry, since only a few years ago the bulk of the papers came from colleges. About sixty papers were presented or read by title. Of these, 60 per cent were written by men and women connected with various institutions of learning, 27 per cent by persons connected with large electric manufacturing and associated concerns, about 8 per cent by the Bureau of Standards and Carnegie Institute, and the remaining 5 per cent may be termed "unclassified." What large manufacturing companies are doing today smaller companies and operating organizations will have to do in the near future.

It is also interesting to note that not a single paper came from a non-electrical industry, although some large industrial organizations in other fields also maintain extensive research staffs. Although this was somewhat of an accident in so far as this particular meeting was concerned, yet we would like to ascribe the fact to the

well-known progressive spirit in our industry. Because of this broad attitude on the part of the managers, research men are allowed to spend some of their time on problems of such an advanced and theoretical nature that no commercial considerations prevent the publication of the results. As a result, the industry as a whole gets the benefit that inures from the best theoretical minds working on its problems, and the electrical art stands ready to interpret new discoveries in physics and to participate in their application for the benefit of humanity.

Leaving the Beaten Path in Station Design

THE new Hell Gate station of The United Electric Light & Power Company, to which we have devoted considerable space in this and our last previous issue, embodies so many departures from conventional design that its novel characteristics cannot be indicated by mentioning any one of them alone. Four features particularly command the attention of all engineers because of their bearing on simplicity, construction cost, economy of operation and continuity of operation. These features are the unusual position of the turbine room, the absolute dependence upon hydraulic sluicing for removal of ashes, the phase isolation of all electrical equipment, and the almost exclusive use of alternating-current motors for auxiliary drive.

With the turbine room next to the river, each condenser draws its circulating water through two short direct connections, and thus the expensive excavation which would otherwise have been required for intake tunnels was eliminated. In addition, this arrangement affords unlimited screening area for the intakes and virtually obviates occasion for the shutdown of any unit because of circulating water.

While there are no ashpits under the furnaces and no auxiliary means of ash removal are provided, the designers have no fear that any interruption of service can arise, because the clinker grinders discharge the ashes in such form that they can be easily flushed away by water through the troughs provided under each boiler. As a result it has been possible to use a much shallower basement than is commonly employed, the fumes and dripping customarily experienced in basements are absent, and the over-all cost of removing ashes is much reduced.

From an electrical viewpoint, the isolation of phases is the most conspicuous feature. It is one that seems well worth while, since a phase-to-phase short circuit in a station of Hell Gate's rating (300,000 kw.) connected with a 1,000,000-hp. generating system would be of a most destructive character. As it is, only a phase-to-ground short circuit can possibly occur, and such a short circuit would be limited to a small value by the generator and bus-tie reactors, by inherent reactance of the generators, and by resistance or zigzag transformers in the grounded neutrals as the case may be. Any disturbances that do arise can be easily cleared by circuit breakers having the unusually large rupturing capacity of 1,500,000 kva.

Though other stations have used electric drive for auxiliaries, this is the first station to adopt alternating current exclusively for this purpose. This practice makes possible the use of very rugged motors (induction type) in nearly all cases, brush-shifting motors being employed for the draft fans. With the squirrel-cage motors, speed adjustments have been possible by pole-changing arrangements or mechanical means.

Hardly less important are some of the minor features, such as the segregation of mechanical and electrical equipment into groups, the large outdoor coal storage and flexible arrangements for handling fuel, the extensive use of motor-operated valves, the provision of truck-type switchboards for station service, and the interlocking of circuit breakers, "disconnects" and cell doors. Truck-type switchboards have become quite common in Europe and could with advantage be used more extensively in this country. Among their merits are safety, simplicity, interchangeability, accessibility, compactness and low cost of installation. Interlocking of switches and cell doors will also be advantageous in other plants, if it does not add excessive complications.

As a whole, Hell Gate station embodies some of the latest ideas in design, and its owners are to be complimented for their courage in departing from conventional practice. In magnitude the requirements may not be duplicated in many other cities, but the fundamental principles are applicable everywhere. The extent to which the adoption of the special features of this station would be justified elsewhere depends on the degree to which the benefits would offset added expense.

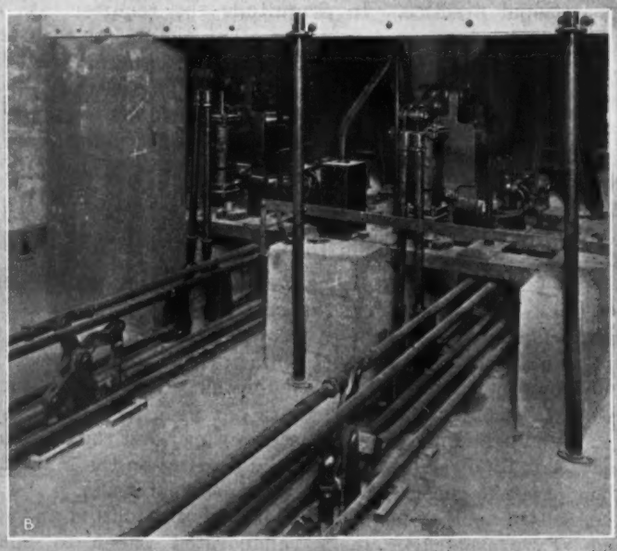
Kilowatt Versus Kilovolt-Ampere Demand Basis for Billing

THE meaning of the various methods of considering power factor in the rate schedule and the dollars-and-cents evaluation of this meaning are something that so far have not been satisfactorily stated. There has, in fact, not been any well-developed basis for such a statement. Moreover, there has been a lack of instruments and methods for ascertaining what the customer's actual power factor is and its bearing on the investment that the central-station company must make.

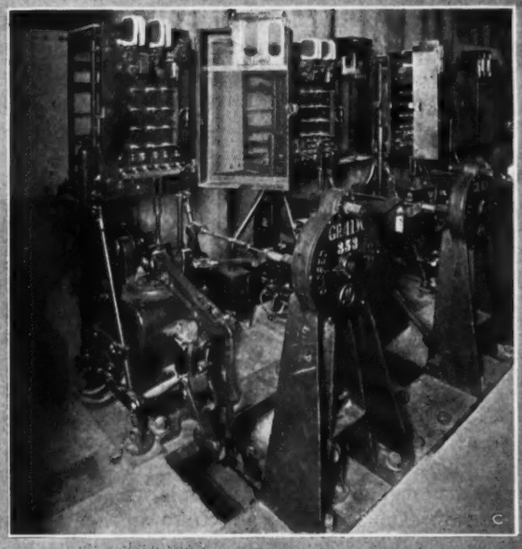
On another page J. E. Doran, J. B. Hodtum and R. C. Fryer endeavor in a collaborated paper to put in words a definition on a kilovolt-ampere-demand basis. They show that on this basis a 23 per cent increase in demand charges over the charges on a kilowatt-demand basis is obtained. This increase is justified because the customer absorbs plant capacity and creates expense in placing this demand on the central station. The argument is an interesting one, and while there will be disagreement with the stand taken, the authors give a statement of at least some of the conditions that must be faced in the sale of energy and that the manager of an electric light and power company cannot afford to ignore. Whether the kilovolt-ampere-demand basis is the final answer to the problem, or whether the kilovolt-ampere-hour basis, or a combination of these and the present energy bases, must be used is a question that no one has yet been able to answer.

So far the various discussions have concerned only the points involved in service to the larger consumers. The effect on a system of the power-factor conditions created by the small consumers has not yet been touched. They are by far the most numerous, and it is a question whether any consistent or satisfactory basis of considering power factor can be developed until the conditions on their installations are at least fairly well known. Our article indicates one of the handholds that must be used in grappling with the question and deserves the earnest consideration of those who wrestle with it.

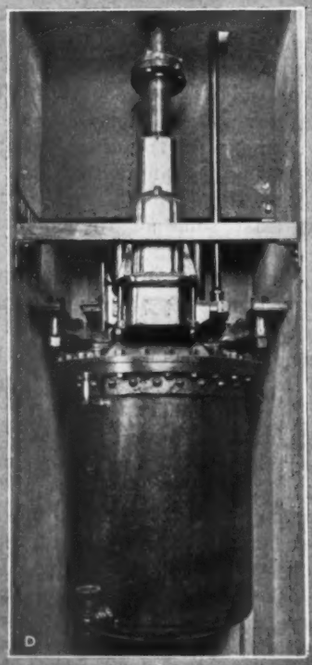
Isolation of Phases at Hell Gate Made Possible by Interlocking Mechanism



B

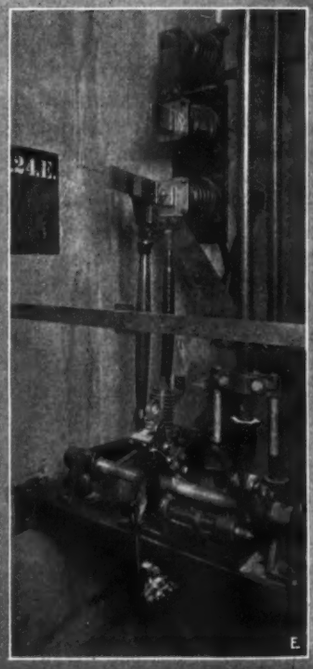


C



D

THE possibility of interphase short circuits is almost entirely prevented in the Hell Gate station of The United Electric Light & Power Company by separating each phase of the three-phase circuits and the corresponding equipment by fire walls and air ducts. The arrangement is shown on page 872. In order to operate the circuit breakers in the three phases simultaneously the solenoids are mounted on the floor above and connected with the circuit breakers by rods and bell cranks. Interlocks are provided so that the disconnecting switches cannot be opened while the oil circuit breakers are closed. The main operating room from which the solenoids are controlled is shown in A, two views of the switch-operating solenoids in B and C, one of the circuit breakers, having a rupturing capacity of 1,500,000 kva., in D, and a mechanically operated circuit-grounding switch in E.



E

Phase Isolation—A Feature of Hell Gate

While This Method of Preventing Interphase Short Circuits Is the Most Conspicuous Electrical Characteristic of the New Station of The United Electric Light & Power Company, Many Other Features Are Embodied

ELECTRICALLY no less than mechanically* the new Hell Gate Station of The United Electric Light & Power Company, New York, has many features of more than ordinary interest to both large and small central-station companies. As might be expected, most of the deviations from conventional practice have been made in order to isolate disturbances and thus to assure a continuity of operation even greater than has been achieved in the company's older plant. Many of the changes have greatly increased the safety of station attendants as well. Chief among the departures from standard practice are the following: Phase isolation of all electrical circuits and equipment; interlocking of circuit breakers and disconnecting switches with operating mechanisms on the floor above; use of a new type of oil circuit breaker with unusually high rupturing capacity (1,500,000 kva.); grounding switches interlocked with "disconnects" on feeder circuits; alternating-current drive of practically all auxiliaries; truck-type switchboards and dead-front panels for station service; simplified excitation with no automatic voltage regulation; duplication of supply for and segregation of control circuits and emergency lighting; use of three-pole overload relays with current-indicating scales on feeder circuits, and provision of a control-circuit terminal room below the main control room. In addition to these features, a unit electrical layout with double ring buses has been adopted, the electrical gallery has been separated from the power station proper, reactors have been inserted in generator leads, feeders and bus-tie circuits; hot-spot temperature indicators have been connected with the main generators and other apparatus, differential protection has been provided on generators, and resistance has been used in the 60-cycle and Z-connected transformers in the 25-cycle neutral ground connection.

STATION LAID OUT FOR 300,000 KW. ULTIMATE RATING

As mentioned in the previous article, the station is laid out for an ultimate rating of 300,000 kw., space being provided for four 35,000-kw., 25-cycle, 11,400-volt turbo-generators and four 40,000-kw., 60-cycle, 13,200-volt generators or for any other combination of these types. Two of each type are already installed. Each generator has its directly connected exciter without automatic regulation because the station will carry the base load of the system. The generator fields are connected permanently through rheostats to the exciter armatures, field control being obtained by adjusting the exciter-field rheostat and the generator-field rheostat simultaneously. This is made possible by single rheostat dial plates, which include both exciter-field and generator-field rheostat contacts. They are mounted on inclosed platforms below the operating-room floor, as are also the neutral switches. The neutral current transformers are in a floor pit directly below the exciter. These transformers and another set at the bus end of the generator leads are connected differentially to relays which trip the generator circuit breakers and field circuit breaker in case of internal trouble. At a later period they may be arranged to trip the steam throttle, the fire-extinguisher valve and the air dampers in the generator ventilating duct. The generators are further protected by inherent reactance (12½ per cent for the 60-cycle machine and 12 per cent for the 25-cycle), by external reactors (5 per cent), and by a neutral ground resistor of 8.4 ohms in the case of the 60-cycle units and by Z-connected transformers in the case of the 25-cycle generators. Six temperature indicating coils are buried in each generator winding at possible hot-spot locations and connected to a temperature recorder near the main control board as a guide to safe operating load. These precautions, in connection with those which will be described later, are very important, because this station is connected with a system which involves approximately 1,000,000 hp. of generating capacity.

Leads from each generator run under the turbine-room and boiler-room floors to the electrical gallery back of the plant and separated from it by a space of 25 ft. (7.5 m.). Because of the rating of the generators it

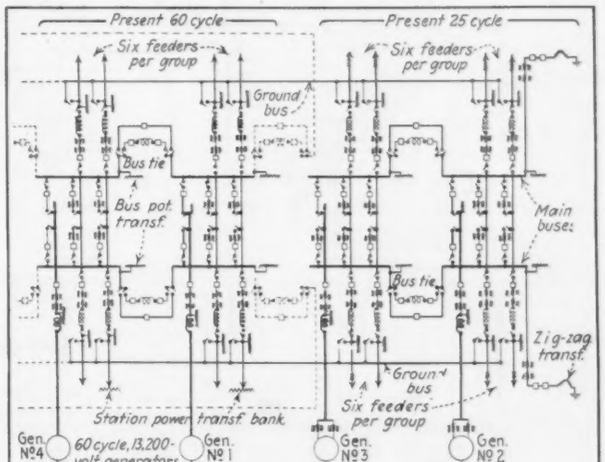


FIG. 1—ONE GENERATOR AND TWELVE FEEDERS CONSTITUTE A UNIT

From each generator the circuit passes through a reactor, a generator circuit breaker and one of two selector switches to the main or auxiliary high-tension bus. Normally these buses will operate in parallel interconnected by bus-tie reactors which can be shunted by a circuit breaker if necessary. The 60-cycle buses can be closed by a loop (shown by dashed lines). Twelve feeders may be energized from each section of either the main or auxiliary bus by closing the corresponding selector switch and feeder switch. Each feeder contains a reactor. The "disconnects" on the outgoing side of the reactors are interlocked with grounding switches so that a feeder may be grounded when disconnected from the bus. Among other features shown are the Z-connected transformer attached to the 25-cycle buses and the resistance between the 60 cycle neutral bus and ground.

*For an account of the mechanical features see ELECTRICAL WORLD, April 29, 1922, page 821.

Layout of Equipment in Electrical Gallery Designed for the Prevention of Interphase Short Circuits

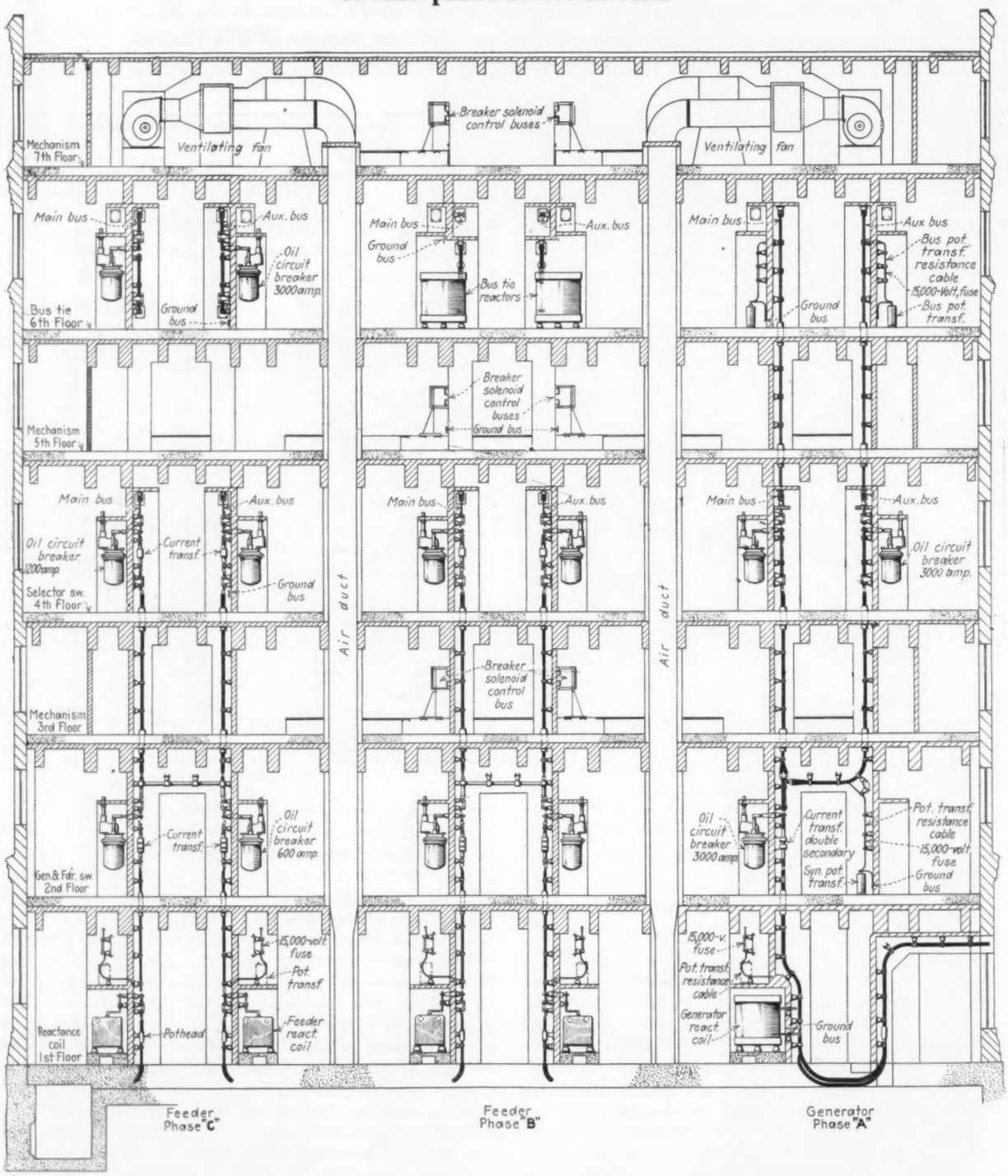


Fig. 2—In cross-section the electrical gallery is divided into three tiers by air ducts and fire walls, each tier being devoted to a single phase. Longitudinally the building is divided into as many sections as there are generators installed (four at present), so that all the circuits connected with any generator are in that section of the gallery corresponding to that particular generator. Hence any short circuit that may occur in any section cannot do more than ground one phase. In general the generator and feeder reactors are on the first floor; the generator and feeder circuit breakers and "disconnects" on the second floor, with operating mechanisms on the floor above; the buses, generator and feeder selector circuit breakers and "disconnects" on the fourth floor, with their mechanisms on the floor above, and the bus-tie reactors and circuit breakers on the sixth floor, with their mechanisms on the floor above with the ventilating fans. The sections depicted have been selected to show typical compartments; actually, however, the equipment for each phase of a generator lead or feeder is in line across the gallery. The method of connecting circuit breakers and "disconnects" with their operating mechanisms is shown on page 873. As indicated there, pipe linkages and bell cranks connect operating solenoids and breakers.

was unwieldy to use one conductor per phase; hence two 1,500,000-circ.mil paper and reinforced rubber-insulated cables were employed in parallel. Under the turbine-room and boiler room floors they are supported by corrugated post insulators mounted in inverted concrete troughs. Between phases are barriers which preclude any interphase short circuits. Above the troughs run the control circuits. In the electrical gallery the circuits run through ducts in the concrete floor, these having been molded by pouring concrete around reinforced spiral paper forms, which were later removed.

The electrical gallery to which the generator leads run is a seven-story concrete structure divided by fire walls and air ducts into three longitudinal tiers or sections, each of which is devoted to equipment in one phase only. This construction, a better idea of which than can be given in words will be had from Fig. 2, affords a unique, simple and positive means of protection against interphase short circuits. It effectually isolates the phases, and failure of any piece of apparatus or equipment can at the worst only cause a ground current, which would be limited, as mentioned before, either by resistors or by Z-connected grounding transformers.

To insure this high degree of protection no flexibility of bus arrangements had to be sacrificed, as may be seen from the accompanying one-line drawing of electrical connections (Fig. 1). Main and auxiliary buses with sectionalizing breakers and reactors between generators are provided for each generator and group of twelve feeders. Furthermore, each generator or feeder has two breakers in series between the bus and circuit terminals, thus affording a double line of defense.

From each generator the circuit passes through a reactor, a generator circuit breaker and one of two selector breakers to a section of the main or auxiliary high-tension bus. Normally the sections will operate in parallel, since they are interconnected by 5 per cent bus-tie reactors which can be shunted by a circuit breaker if necessary. When the station is completed the 60-cycle bus can be closed by a loop (shown by dashed lines). Twelve feeders may be energized from each section of either bus by closing the corresponding selector and feeder switch. Each feeder contains a 3 per cent reactor. Station-tie reactors have 5 per cent reactance and the house-service transformer reactors have 12.72 per cent reactance. The disconnecting switches on the outgoing side of the reactors are interlocked with grounding switches so that a feeder may be grounded when disconnected from the bus, but at no other time.

The relative positions of the equipment mentioned can best be understood by again referring to the cross-sectional view of the electrical gallery. On the first floor are the generator and feeder reactors, on the next floor are the generator and feeder circuit breakers and "disconnects," and on the floor above are the switch-operating mechanisms. On the fourth floor are the buses, generator and feeder selector switches and "disconnects," while above, again, are the operating mechanisms. The sixth floor is devoted to bus-tie reactors, circuit breakers and disconnecting switches, while the operating mechanisms are on the seventh floor with the ventilating fans. Expressed in the simplest terms, the generator circuits feed up to the buses on the fourth floor and the outgoing circuits feed down from this point.

Longitudinally the building is divided into as many

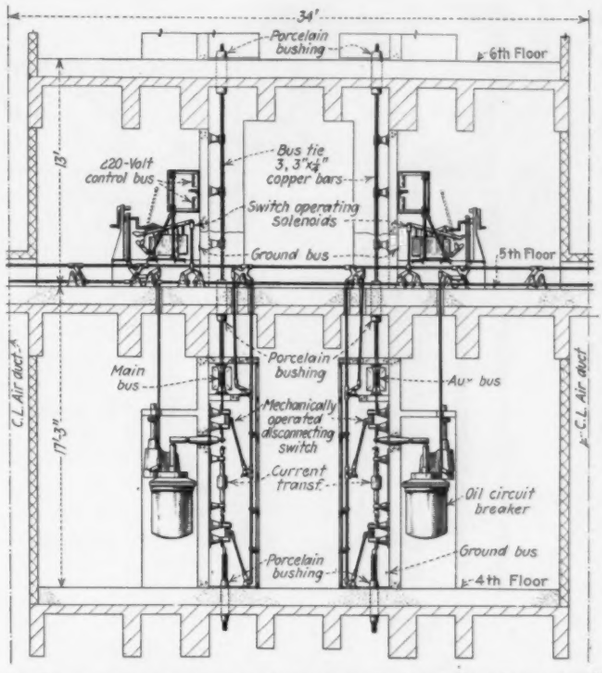
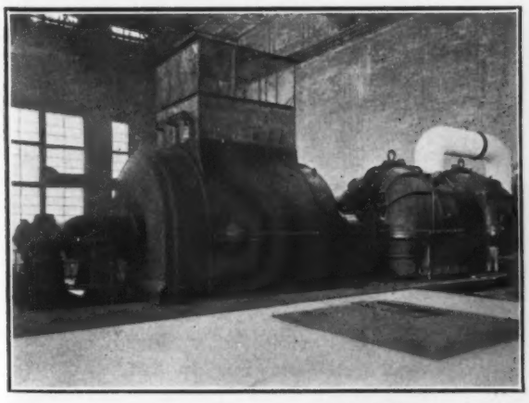
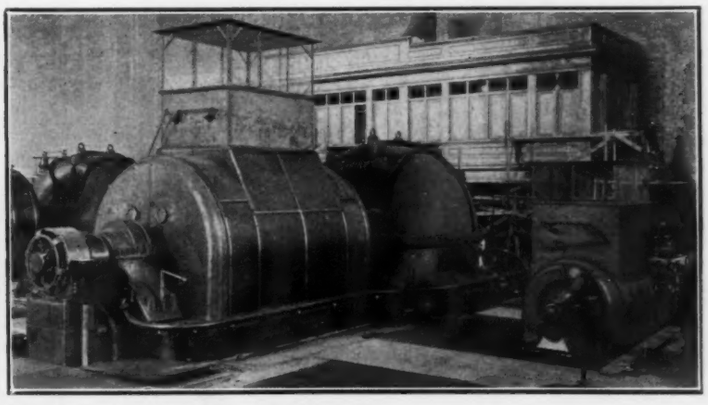


FIG. 5—INTERLOCKED OIL CIRCUIT BREAKERS AND "DISCONNECTS" WITH CIRCUIT-BREAKER-OPERATING SOLENOIDS ABOVE

The arrangement shown is typical of the method of connecting the interlocked oil circuit breakers and disconnecting switches with the circuit-breaker-operating solenoids on the floor above for the B phase of a selector switch floor. The solenoid on the right operates the auxiliary bus breakers and interlocks with the "disconnects" in the A, B and C-phase tiers by pipe linkages and bell cranks, as shown, while the solenoid on the left is connected with the main bus equipment. The bell cranks are so designed that the "disconnects" and circuit breakers cannot be opened and closed in the wrong order. In addition, accelerating devices are attached to the pipe mechanism to offset its inertia. This illustration also shows the buses running to the bus-tie breakers on the floor above.





FIGS. 3 AND 4—TWO TYPES OF TURBO-GENERATORS ARE INSTALLED

The one at the left is a tandem-compound unit rated at 40,000 kw., 60 cycles and 13,200 volts. The unit at the right is rated at 35,000 kw., 25 cycles and 11,400 volts.

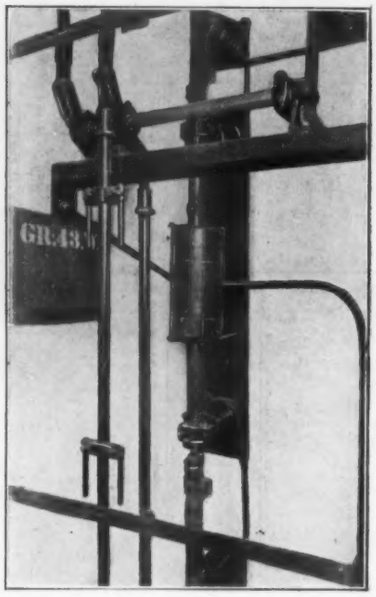


FIG. 6—CELL-DOOR LOCK OPERATED BY BREAKER MECHANISM

bays as there are generators (four being the present number), and thus all circuits, including feeders, which are connected with any generator are in a bay corresponding to that particular generator. The circuits and equipment for the 25-cycle generators are at one end of the gallery, and the equipment for the 60-cycle apparatus is at the other end of the gallery. Owing to the fact that the equipment is not opposite the particular generators involved, a subway had to be run below the electrical gallery in a longitudinal position. The sections shown have been selected to depict typical tiers. Actually, however, the equipment for each phase of a generator lead or feeder is in line across the gallery. Aside from phase isolation, the electrical gallery is noteworthy because of the arrangements made for interlocking the circuit breakers, "disconnects," cell doors and feeder-grounding switches and for operating the apparatus in each of the three phases of a circuit simultaneously. As may be observed from Figs. 2 and 5 the circuit breakers and corresponding "disconnects" of the same phase are mounted on opposite sides of the same wall and connected with the operating mechanisms on the floor above by bell cranks and pipe linkages acting in tension. The same linkages prevent opening of the cell doors or closing of a feeder-grounding switch when the circuit is "alive." Interlocks are also provided so that the disconnecting switches may not be opened or closed after the oil circuit breakers have closed. Interlocking of the circuit breakers, "disconnects," grounding switches and cell doors prevents accidents of a kind that have occurred in plants where interlocking has not been provided.

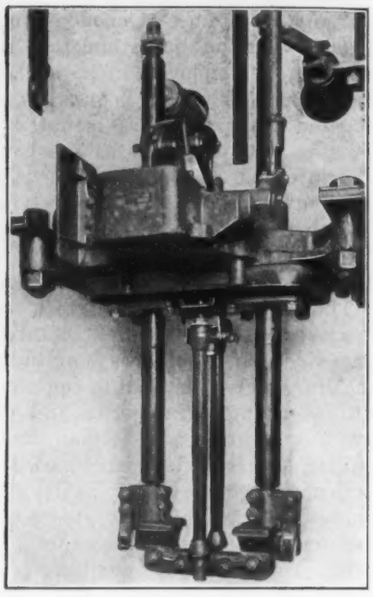


FIG. 8—CONTACTS OF 1,500,000-KVA. CIRCUIT BREAKER

To insure that closing and tripping shall take place with adequate speed, an accelerating device is attached to each solenoid and each bell crank above each pole unit. With this arrangement a closing speed of 0.3 second has been obtained at normal control voltage without sacrificing the inherently high tripping speed of the breakers. Closing and tripping is performed with 250-volt battery energy, duplicate sources of supply being provided. In case anything should go wrong with the automatic apparatus the switches can still be operated by a hand lever which is attached to the operating mechanism.

The method of operation just described has been made possible by the use of a new type of oil circuit breaker, one which is interesting also because of its unusually high rupturing capacity, namely, 1,500,000 kva. For this rating the oil tanks of the breakers, which measure only 28 in. (71 cm.) inside diameter, are relatively small. Among the characteristics of these breakers are the following: The tanks are grounded and lined with asbestos and micarta; protected butt-type condenser terminals are used; parallel-path contacts and arcing tips are employed which are wholly immersed in oil and opened by gravity; the breaker is fully automatic and anti-pumping; the tank is attached by six bolts to a cast-steel head and is vented through a check valve to a header. The lining is a good insulator and practically indestructible from arcing. By virtue of their arrangement the contacts are forced closer together during short circuits. The six-bolt connection makes tank removal easy, while venting by the check valve is expected to prevent any throwing of oil.

All of the generator, generator-selector and bus-tie breakers are rated at 3,000 amp., the feeder breakers at 600 amp. and the feeder selector breakers at 1,200 amp.

Control of this apparatus and starting and stopping of the generators are supervised from the main control room on the fourth floor of the electrical gallery. In general the layout of this room is on a plan quite similar to that used in other New York stations, consisting of a central machine control bench with the machine-control instrument board in front and a semi-circular feeder-control board behind. The machine-control bench carries the

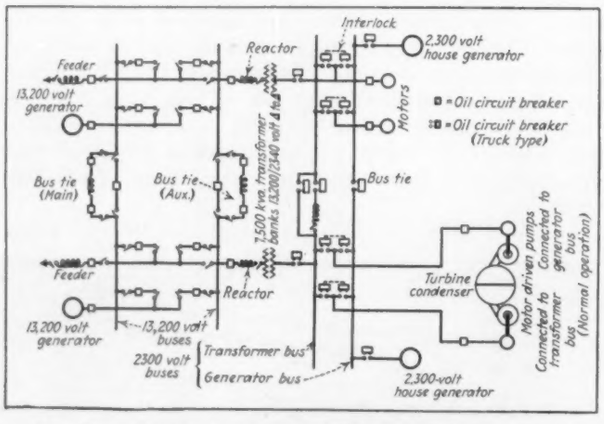
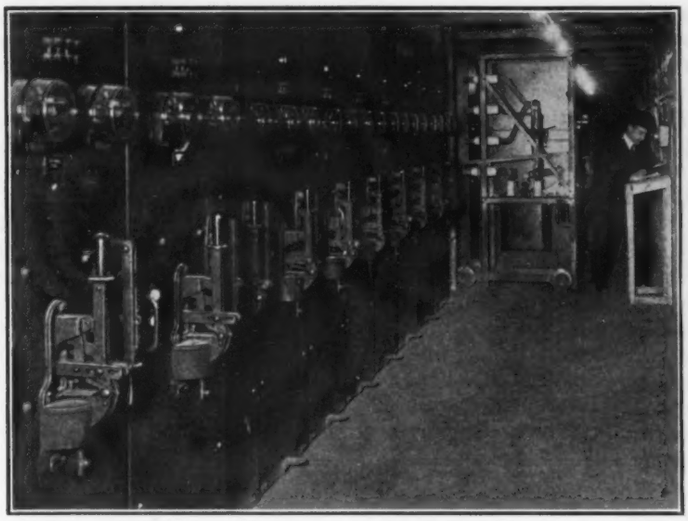
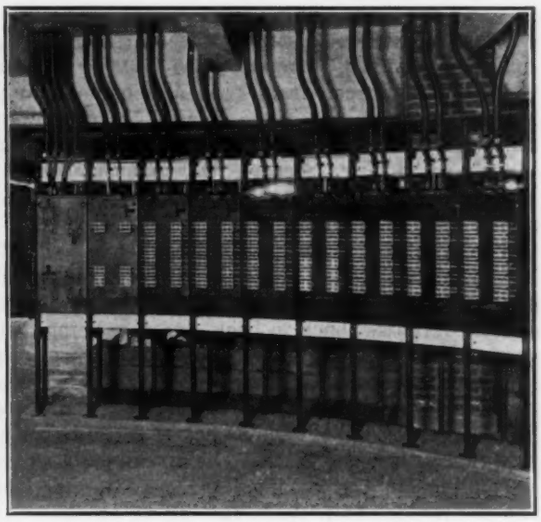


FIG. 7—STATION AUXILIARIES MAY BE FED EITHER FROM HOUSE GENERATOR OR MAIN UNITS

Schematically the method of assuring reliable auxiliary service and establishing a heat balance is shown by this one-line drawing. Where duplicate auxiliaries are provided, one is driven from the transformer bus and one from the house generator, the remainder being apportioned between the buses so that a heat balance may be obtained by adjusting the relative loads of such units as the forced-draft fans, boiler-feed pumps, etc. With this arrangement no service involving duplicate auxiliaries can be totally interrupted and any auxiliaries may be quickly transferred from one bus to the other. As may be observed, the transformer bus is sectionalized and has two sources of supply, either of which may be connected to either the main or the auxiliary bus. The house-turbine bus also has two sources of supply and is sectionalized.





FIGS. 9 AND 10—TRUCK-TYPE SWITCHES SERVING STATION AUXILIARIES AND CONTROL-TERMINAL BOARD BELOW THE MAIN SWITCHBOARD

usual complement of master switches and indicating lamps for controlling the generator and generator-selector circuit breakers, turbine governors, generator rheostats and turbine-room signals, while the instrument board carries such indicating instruments as generator temperature indicators, bus and generator voltmeters, wattmeters, synchroscopes, synchronizing voltmeters and frequency meters. Testing terminals for checking and calibrating meters, watthour meters and differential relays are mounted on panels back of the machine-control instrument board.

The feeder-control switchboard is very compact. The instruments and control switches for four circuits are mounted in vertical rows on each panel, though the panels are only 25 in. (62.3 cm.) wide. To permit this edgewise-type wattmeters and power-factor meters and three-pole overload relays—*i.e.*, three single relays mounted one above the other in a single case—are employed. These relays have the additional feature of having a definite minimum time setting and a current-indicating scale sufficiently accurate for all purposes and showing also whether current is flowing in the relay. To assure that the direct-current trip element of these relays shall be in operative condition, the pilot-lamp circuits are supervised through the relay and breaker trip circuit. Hence any open connection may be instantly detected by the failure of a lamp. Above each pilot lamp is a push-and-pull switch by which the lamp circuit can be opened when a circuit is de-energized to prevent confusion from the lights. Test terminals are provided at the bottom of each panel.

The wiring on the back of the board attracts special commendation because the control wires are bunched and held in fiber clamps, at right angles to and back of each panel frame. This construction leaves the back of the board clear of wires except for the few running from the risers to the terminals.

Back of the feeder switchboard is another semi-circular board on which relays and recording or integrating meters are mounted. Virtually all the panels in this station are made of ebony transite.

Much of the trouble sometimes experienced in tracing, changing and testing control and instrument wiring has been avoided in this plant by providing a special control-terminal room just below the main control room. The control and instrument circuits enter this room through conduit from all parts of the station and are attached to terminal boards arranged in switchboard form. No joint or tap in the entire length of any of the wires is permitted. All wires are labeled and occupy the same relative position on duplicate panels, thus minimizing the possibility of error in connecting, reconnecting and testing.

The main house-service board—the one controlling the house generators and house-service transformers—is erected on a gallery in the turbine room opposite the heat-balance board. At present there are two banks of 7,500-kva., 13,200/2,340-volt delta-delta house-service transformers. These are connected with the main buses and house-service bus as shown in Fig. 7. Schematically this indicates how reliable auxiliary service is assured and a heat balance established. Where duplicate auxiliaries are provided one is driven from the transformer

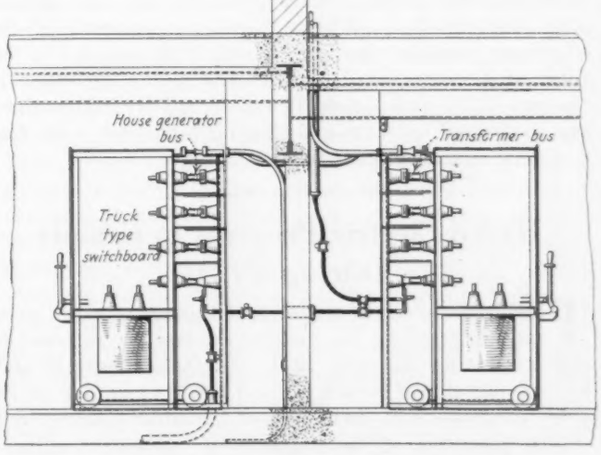


FIG. 11—TWO ROWS OF TRUCK-TYPE SWITCHBOARDS SET BACK TO BACK SERVE STATION AUXILIARIES

One row of trucks is connected to the house-generator bus and the other row to the transformer bus, the trucks opposite each other being joined to the same auxiliary. The connections are made at the back by jack-type connectors so that any truck may be withdrawn and replaced by another, if the circuit breaker is open, by pulling out the locking lever. Additional interlocking is provided to prevent putting the same auxiliary on both buses at the same time. The trucks are self-contained, carrying an oil switch, instrument transformers, etc., which are readily accessible for inspection or maintenance when the truck is withdrawn.

bus and one from the house generator. The remainder are apportioned between the buses so that a heat balance may be obtained by adjusting the relative loads of such units as the forced-draft fans and boiler-feed pumps. With this arrangement no service involving duplicate auxiliaries can be totally interrupted. Other auxiliaries may be quickly transferred from one bus to the other. As may be observed, both buses are sectionalized and either may be energized from two sources.

The type of equipment and arrangement afforded for quickly changing any auxiliary from one bus to another are shown in Figs. 9 and 11. They illustrate truck-type switchboards set back to back, one row being connected to the transformer bus and one to the house-generator bus. The trucks opposite each other are connected to the same auxiliary. At the back of each truck are jack-type connectors which enable any truck to be withdrawn and replaced by another, if the circuit breaker is open, by pulling out the locking lever. Additional interlocking is provided to prevent putting an auxiliary on both buses at the same time. The trucks are self-contained, each carrying an oil switch, instrument transformers, relays, etc., which are readily accessible for inspection or maintenance when the truck is withdrawn. Among other advantages claimed for these trucks are compactness, safety and a lower installation expense than that of permanent switchboards.

As previously mentioned in this article, virtually all of the auxiliaries are driven by alternating current, even the coal towers, boiler-feed pumps, stokers and fans. All motors rated at 40 hp. and more are operated at 2,200 volts, except the coal towers, stokers, cranes and skip hoist, while motors under 25 hp. are operated at 220 volts or 440 volts. The motors for driving the forced-draft and induced-draft fans are of the brush-shifting, adjustable-speed type and the boiler feed pumps are driven by adjustable-speed wound-rotor induction motors. The clinker grinders are driven by two-speed squirrel-cage induction motors. All of the remaining auxiliaries, such as circulating, hot-well, dry-vacuum, booster and ash-handling pumps, are driven by constant-speed induction motors. To obtain adjustable speed from such motors the stokers are driven through double-cone transmission. Where starting equipment of the oil-circuit-breaker type is required, it is provided in the form of a switchboard close to the motor, although in the case of the induced-draft and forced-draft fans these are controlled by start-and-stop push-buttons with fast and slow auxiliary buttons.

Hydro-Electric Progress in Canada During 1921

THE hydro-electric industry of Canada, though naturally affected by the general depression, suffered no setback during the year 1921. In fact, almost 300,000 hp. was developed, which stamps the year as one of the most progressive in the history of Canadian water-power.

The progress of development is somewhat difficult to follow from year to year because a year is too short an interval. From three to five years or often longer elapse between the first consideration of a development and the delivery of power. Again, most projects commence with an initial installation much less than the ultimate projected capacity, and new units of machinery are installed from time to time as the load develops.

The yearly survey of the Dominion Water Power Branch indicates that the 300,000 hp. installed during 1921 is made up of both equipment for newly completed projects and additions to existing plants, and besides this a considerable amount of new construction was initiated, which insures that as the old power plants reach their capacity new ones will take their place in maintaining the continued growth and prosperity of Canadian hydro-electric enterprise.

That Canada is not lagging in this respect is indicated by comparison with the United States. In 1902 the horsepower installed per 1,000 population in Canada was 47, while in 1920 it had increased to 280 horsepower. In 1902 the United States reported 26 hp. for each 1,000 population, while in 1920 this had increased to only about 93 hp. The total increase in horsepower installed in Canada from 1900 to 1920 was 153 per cent.

The accompanying table gives in detail the developed and potential water powers of Canada. It will be seen from this table the Province of Ontario led the other provinces in new water-power installations, with 173,650 hp. Ontario also has the largest total installation in water-power plants with 1,212,650 hp., being followed by the Province of Quebec with 1,015,385 hp. The total rating of all the hydro-electric plants in Canada on Jan. 1, 1922, was 2,755,980 hp., which indicates that about 18 per cent of the minimum water powers of the country have been developed.

DEVELOPED AND AVAILABLE WATER POWER IN CANADA

Province	Turbine Installation, Hp. On Jan. 1, 1921	Installed During 1921	On Jan. 1, 1922	Available Twenty-four Hour Power at 80 per Cent Efficiency At Ordinary Minimum Flow, Hp.	Dependable for Six Months, Hp.
British Columbia	305,115	200	305,315	1,931,142	5,103,460
Alberta	33,187	.....	33,187	475,281	1,137,505
Saskatchewan	.....	.....	.....	513,481	1,087,756
Manitoba	83,447	13,800*	97,247	3,270,491	5,769,444
Ontario	1,039,000	173,650	1,212,650	4,950,300	6,808,190
Quebec	926,095	89,290	1,015,385	6,915,244	11,640,052
New Brunswick	21,180	9,000	30,180	50,406	120,807
Nova Scotia	34,073	12,875	46,948	20,751	128,264
Prince Edward Island	1,869	.....	1,869	3,000	5,270
Yukon and Northwest Territories	13,199	.....	13,199	125,220	275,250
	2,457,165	298,815	2,755,980	18,255,316	32,075,998

*Includes two units in the Queenston plant.

The Power Commission of Nova Scotia and New Brunswick has successfully carried out the first provincial development and is virtually ready to deliver electrical energy to the principal cities of these provinces. In Ontario the Queenston-Chippawa plant of the Hydro-Electric Power Commission of Ontario has been placed in operation with two 60,000-hp. units installed. In Manitoba the Manitoba Power Commission has extended its activities and has under active construction an important development at Great Falls, on the Winnipeg River, with an ultimate capacity of 168,000 hp.

The figures for available power are based upon rapids, falls and power sites concerning which definite or well-established information is at hand. Many feasible power sites are scattered from coast to coast which have not been investigated and placed on record. As illustrative of the conservative nature of these figures, attention might be called to the Provinces of New Brunswick and Nova Scotia, where detailed analyses have disclosed most advantageous reservoir facilities for regulating stream flow and where it is estimated that, after providing for the diversity factor between installed power and consumers' demand, these two provinces together possess within their borders between 200,000 and 300,000 commercial horsepower.

Kva. Basis Favored for Demand Billing

Studies Lead to Belief that Power Factor Is Too Inconvenient to Measure and Utilize to Be Employed as Basis for Demand Charges—Effect of Kva. Demand Basis on Billing

By J. E. DORAN, J. B. HODTUM AND R. C. FRYER
Engineers Union Gas & Electric Company, Cincinnati, Ohio

DEFINITION and measurement of power factor is basically a question of methods to prevent economic losses caused by power factors less than unity. Were it not for these economic losses it would not be necessary to measure power factor—a term used herein in the abstract sense. It is first proper to analyze and define in order to determine whether the economic loss is directly or indirectly proportional to power factor. It is believed that possibly the power factor of an alternating-current circuit is not the measure of the loss in that circuit that takes place when the current and potential are out of phase. Two forms of loss due to out-of-phase current and potential exist.

The first loss taking place in circuits with power factor other than unity is the economic loss caused by the increase in investment to carry a fixed load at low power factor over the investment required to carry the same load at unity power factor. Because of this it is customary for the manufacturer to rate his apparatus in terms of kilovolt-amperes.

Central Stations Attempt to Correct for Power Factor

The central-station company pays for apparatus upon a kilovolt-ampere rating. It has been selling the use of this apparatus by the year or the month, in its demand charges, at so much per kilowatt. Realizing that sufficient revenue must be produced from this demand charge to cover fixed charges, the central station has placed a value upon the kilowatt demand which is sufficient to produce the desired return, even at power factors other than unity. It is evident that if two customers have equal loads, one operating at unity power factor and the other operating at low power factor, but both customers paying for their demand upon a kilowatt basis, the customer with the low power factor is actually using a greater proportion of the producing company's capacity than is the customer with the high power factor. To adjust this condition, many central-station companies place a "power factor" clause in their contracts to recover from the low-power-factor customer the compensation for the additional capacity he is tying up. This compensation clause, however, is applied against a kilowatt measurement, though the kilowatt is not proportional to the cost of supplying demand, except over a very small portion of the investment charge, as will be shown below.

For a group of representative companies, inventories show chargeable to used and useful physical property for electrical production and distribution an average of $9,974,201. Of this, $1,585,152 is chargeable to steam equipment only, or 15.8 per cent of the total amount chargeable to electrical production and distribution. A kilowatt demand could be considered as proportional, within certain limits, to only 15.8 per cent of the total investment charge. The remaining 84.2 per cent represents the cost of generators, substation and transformer equipment, underground and overhead lines, etc., for which the central-station company is paying the manufacturer upon a kilovolt-ampere basis. The central station is selling this capacity to its customers on a kilowatt basis. To establish the lack of equity in basing the demand charges upon a kilowatt basis, it is necessary to remember only that any customer with a low power factor is using, without charge, more units of system capacity throughout the major portion of the investment serving him than he is paying for. If for every kilovolt-ampere supplied a customer is using a direct proportion of 84 per cent of the investment, it seems sound economics to collect demand charges upon that basis.

A kilowatt does not represent the total demand even against that portion of the investment chargeable to steam because the coal pile is carrying the energy losses due to effective idle or magnetizing current at low power factor. This loss is a variable, dependent upon the effective idle amperes and the resistance in the system circuits. Therefore, at any power factor other than unity the kilowatt does not represent a true proportion for measurement of demand against the steam investment, which in the specific example is shown to be 15.8 per cent.

The Question of Allowable Power Factor

Extensive use has been made of 80 per cent as an allowable power factor. This neglects the fact that if proper voltage is maintained, a customer's power factor is not appreciably affected by the power factor of the circuit from which he draws his power. John Jones may have a power factor of 60 per cent, while his next-door neighbor on the same circuit may operate at unity with proper equipment. Why, then, should the central station, allowing 80 per cent as minimum power factor, sacrifice 20 per cent of income from 84 per cent of its investment because John Jones has not, for some reason, purchased motors of a size that will operate at unity with his load, and why, unless the diversity factors are taken into consideration and unless a 20 per cent value is considered a correction for some factor or factors of diversity, should the central station give John Jones back as much as 20 per cent of its demand revenue from 84 per cent of its investment, when conditions approach ideal?

As an example, take one contract which specifies that the billing demand shall be (75 ÷ power factor of demand interval) × kilowatt demand of the same interval when the power factor is below 75 per cent, and when above 80 per cent at the interval during which demand occurs billing demand shall be (80 ÷ power factor of demand interval) × kilowatt demand.

On this basis, assuming a rate of $18 per kilowatt for the first 500 kw. demand per year and $15 for each additional kilowatt demand per year and an actual hourly demand of 2,800 kw. during which hour the reactive component meter showed a reading of 3,600 reactive kva., the demand rate would yield as follows:

With 2,800 kw. demand and 3,600 reactive kva. our power factor is 61 per cent. The billing demand is therefore (76 ÷ 61) × 2,800, or 3,443 kw. Therefore:

500 kw. at $18 = $9,000 yearly,
2,943 kw. at $15 = $44,145 yearly,

and total yearly kilowatt-demand charge is $53,145.

This is based upon power factor taken during the demand interval, which is doubtless higher than the so-called "average monthly power factor."

By the use of an accurate kilovolt-ampere meter, however, we might obtain the following:

2,800 kw. at 61 per cent power factor = 4,500 kva. (reading of kilovolt-ampere demand meter).

500 kva. at $18 × 84 per cent = $7,560
4,050 kva. at $15 × 84 per cent = 51,030
500 kva. at $18 × 16 per cent = 1,440
2,300 kva. at $15 × 16 per cent = 5,520

Total $65,550

To this should be added the demand load on the 16 per cent representing the steam-end investment, this demand being effective idle I^2R losses as follows: Total current at time of demand, 197 amp.; inphase current at time of demand, 122.5 amp.; total I^2 — inphase I^2 × 1.42345 ohms (actual resistance) per conductor = 33.8 kw. effective idle I^2R loss per conductor. Three conductors therefore produce a total loss of 101.4 kw. supplied by steam. Considering generator loss as 3 per cent, at full load the effective idle I^2R losses in the generator are 15 kw.

	Kw.
Line losses =	101.4
Generator losses =	15.0
Total losses due to effective idle current =	116.4

116.4 kw. at $15 × 0.16 = $279.36

Adding this to $65,550 makes $65,829, which shows a net loss on the demand rate with power-factor correction as compared with a power-factor rate considering property investment of $12,684, or 23 per cent.

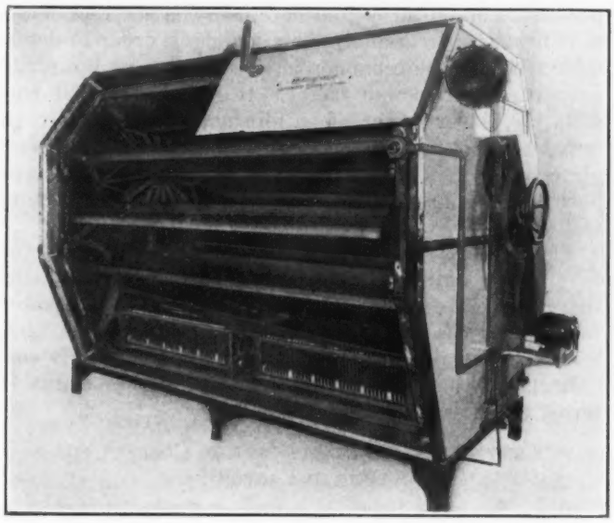
This is based upon the assumption that the rate per kilovolt-ampere demand per year is the same as the present rate per kilowatt demand per year. This assumption is made because of the manner in which the present kilowatt rate was worked out. The question of rate per kilovolt-ampere demand is an individual one. In some cases the rate per kilovolt-ampere should be less, in some the same, and in other cases higher than the kilowatt demand rate now in effect. The quantities used can be measured by a graphic watt-hour demand meter and a graphic kilovolt-ampere meter. Had this contract been made upon a kilovolt-ampere basis, the metering could have been done with a polyphase watt-hour meter and a kilovolt-ampere demand meter with proper time intervals. The kilovolt-ampere meter would not necessarily be a graphic instrument. Not only does a power-factor-correction clause fail to define correctly the demand, but the method of obtaining the necessary factors upon which to base the correction requires more complicated metering than would be necessary with the same contract based upon kilovolt-ampere demand.

Economies of Electric Ovens for Baking Bread

Reel and Continuous Conveyor Type Electrically Heated Bake Ovens Show Savings in Cost of Operation and Materials Used

BY WIRT SCOTT
Manager Industrial Heating Section, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

DEVELOPMENTS in the application of electric heat to bread-baking ovens have reached a stage where absolute certainty as to the uniformity and quality of the product is assured and where distinct savings in labor, time and material have been realized. The number of installations that have been made indicates the increasing use of these ovens in commercial bakeries. From tests on electric ovens in regular use valuable data have been obtained showing remarkable and unexpected economies effected in the cost of operation.



REEL TYPE ELECTRICALLY HEATED BAKE OVEN

A reel-type bread-baking oven and a continuous-conveyor shelf-type baking oven, both types electrically heated, with the temperatures automatically controlled, have been thoroughly tested in actual operation and are in daily use, producing the highest quality of bread, pies, cakes and pastry. The capacity of an oven in loaves per hour or per bake depends upon the weight of the loaf and the size of pan used. On this basis the output of the reel oven is as follows:

Product	Size Pan	No. per Bake	No. per Hour
1-lb. loaf	4½-in. x 9¾-in.	136	250
1-lb. loaf	4½-in. x 8½-in.	120	200
1½-lb. loaf	5 -in. x 11-in.	112	160
1½-lb. loaf	5½-in. x 9¾-in.	96	150
Pies	10-in. diam.	56	112

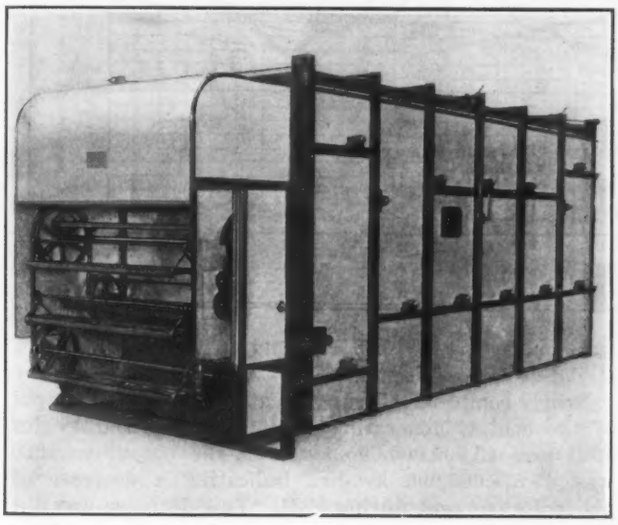
Capacity of reel oven (kw.)	25
Time required for heating up from cold oven to 450 deg. Fahr. (minutes)	40
Length of time required for baking 1-lb. loaves (minutes)	25 to 28
Length of time required for baking 1½-lb. loaves (minutes)	35 to 38
Radiation losses of oven at 450 deg. Fahr. (kw.-hr.)	8
Power consumption, including radiation losses, per pound of bread baked (watts)	100
Power consumption baking 150 1½-lb. loaves per hour (kw.-hr.)	21.5

The conveyor ovens are made in two sizes, nominally rated at 600 and 1,000 1½-lb. loaves per hour. The continuous-conveyor type ovens, being of larger capacity, are still more efficient than the reel ovens. Oper-

ating results obtained show that a pound loaf can be turned out with a consumption of 80 watts.

A very important advantage of the electric bake oven is that when an oven is so constructed as to retain the steam driven out of the bread it is unnecessary to inject live steam into the oven. This eliminates the necessity for steam boilers, which is of considerable importance, particularly in case of the small bakery.

It has been found that a loaf of bread baked in an electric oven stays fresh much longer than a loaf baked in other ovens and that the grain structure is much more uniform. The fact that an oven will turn out its rated capacity continuously, without shifting of the bread after it is placed in the oven, is also of vital importance, as is the automatic temperature control. But under present financial conditions the baker must be shown how he will actually save money before investing. Some very important operating data just obtained from an installation at Fisher Brothers' bakery in Cleveland, using two of the continuous-conveyor-type ovens, have been verified and the results duplicated with the reel-type oven. Two 1,000-loaf conveyor-type ovens have been in operation in this bakery for a period of one year. Formerly natural gas containing approximately 1,000 B.t.u. per cubic foot was used for fuel, costing 30 cents per 1,000 cu.ft. The gas bill per day amounted to $6. The electric bill, at a rate of 2.38 cents per kilowatt-hour, amounted to $36 per day. No complaint was made as to increased operating costs since the greatly improved quality of bread produced in the electric oven offset, so it was stated, the difference between the gas and electric bills. However, in course of time a very unlooked-for saving occurred, and the way in which it came about is of vital importance in developing the use of the electric bake oven.



CONTINUOUS CONVEYOR TYPE ELECTRICALLY HEATED BAKE OVEN

At the end of several months' operation it was found that the amount of flour required per week to turn out 125,000 1½-lb. loaves of bread was much less than had been the case with gas ovens. An investigation showed that in producing with the electric oven a 24-ounce loaf of bread, weighed twelve hours after being baked according to standard practice, it was not necessary to use the same amount of flour as had formerly been used. Further investigation showed that each barrel of flour actually produced ten additional 1½-lb. loaves. Fisher Brothers are using on an average 57 barrels of flour per day and, owing to the electrically baked loaf, are actually obtaining 570 more 1½-lb. loaves than they formerly obtained. With bread selling at 11 cents per loaf, the additional income amounts to $62.70 per day. Deducting the power bill of $36 per day, it may be said that the firm is now doing its entire baking at no cost for heat and making an additional profit, as compared with the use of gas, of $26.70 per day.

On the basis of the above results and later investigations, a table has been compiled using as a basis for computation the saving of three-quarters of an ounce of dough on each 24-ounce loaf of bread. This table is made on the basis that with a gas oven the bread is scaled at 27 ounces and with the electric oven at 26¼ ounces.

SAVINGS IN QUANTITY OF FLOUR EFFECTED BY USE OF AUTOMATIC ELECTRIC BREAD-BAKING OVEN

Number of Loaves Daily Output		Increase By Using	Reel Type—Increase in Daily Revenue When Bread Sells at Following Prices per Loaf					
Gas Oven	Electric Oven	Electric Oven	10 Cents	11 Cents	12 Cents	13 Cents	14 Cents	15 Cents
2,000	2,057.2	57.2	$5.72	$6.29	$6.87	$7.44	$8.00	$8.59
3,000	3,085.8	85.8	8.58	9.43	10.29	11.13	12.01	12.86
4,000	4,114.4	114.4	11.44	12.60	13.72	14.89	16.01	17.18
5,000	5,143.0	143.0	14.30	15.72	17.18	18.5	20.02	21.46
6,000	6,171.6	171.6	17.16	18.86	20.58	22.26	24.02	25.72
8,000	8,228.8	228.8	22.88	25.20	27.44	29.78	32.02	34.36
10,000	10,226.8	226.8	28.60	31.44	34.36	37.18	40.04	42.92
12,000	12,343.2	343.2	34.32	37.72	41.16	44.52	48.04	51.44
14,000	14,400.4	400.4	40.40	44.06	48.02	52.04	56.04	60.08
15,000	15,429.0	429.0	42.90	46.16	51.54	55.77	60.06	64.38

For example, assume that a baker turns out 2,000 1½-lb. loaves per day using gas ovens, also that his bread retails at 13 cents a loaf. Referring to the table, it will be seen that the same amount of flour will produce 2,057.2 1½-lb. loaves baked in an electric oven, or 57.2 additional loaves, which at 13 cents per loaf, retail price, gives an increased revenue of $7.44 per day, more than paying for the power bill at the average rate.

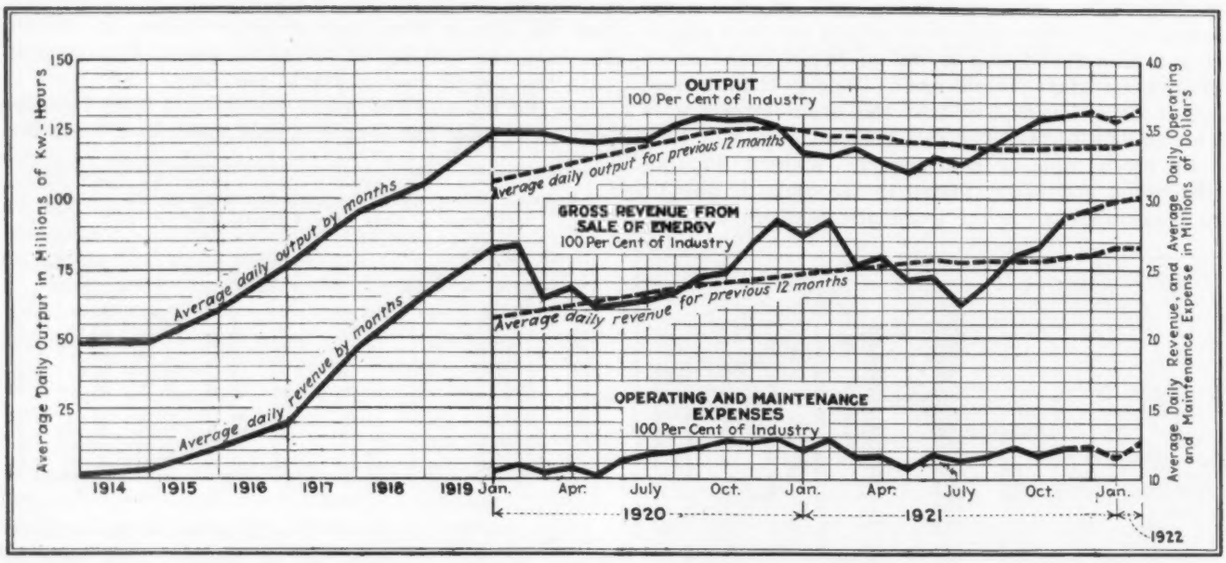
National Standardizing Bodies Organized in Japan and Norway

STANDARDIZATION work in Japan has recently been given a great impetus by the organization of the Japanese Engineering Standards Committee. The main function of this committee is to serve as a bureau for solving and initiating problems involving engineering standardization. The committee consists of seventy members, presided over by the Minister of the Department of Agriculture and Commerce, acting as president, and a vice-president, who is elected or appointed. The details of the work are handled by seven secretaries who are engineers of the government Departments of Agriculture and Commerce, Communications, Railways, Military Engineers and Naval Engineers. The work is being pushed with vigor, investigations already being under way on metals, woods, bricks, screws, electric wires and electric motors.

In Norway a national standardization committee has been organized by the Federation of Norwegian Industries.

There are now national standardizing bodies in Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden, Switzerland and the United States.

Record Output and Revenue During February



TWO new records were hung up by the electric light and power industry during February. Reports for the month received by the ELECTRICAL WORLD from central generating and distributing companies representing 77 per cent of the installed rating of the industry indicate that the average daily output was 132,720,000 kw.-hr., which exceeded the previous record, made during December, by 1,840,000 kw.-hr., and that the average daily gross revenue was $3,028,000, which exceeded the former high figure, set during January, by $48,000. February being a short month, however, the total output for these items for the month fell considerably below the record monthly output of last December and the record monthly revenue of January.

In spite of the fact that the lighting load undoubtedly decreased during the month owing to the advancing season, every section of the country reported increased electrical energy requirements during February, indicating a material increase in the industrial load during the month. This increase was most pronounced in the North Central and Mountain-Pacific sections and was least apparent in New England, where there was a strike in the textile mills.

Nearly complete returns indicate that the total output of the central generating stations in the country for 1921 was 43,905,000,000 kw.-hr. The output in 1920 was 45,678,000,000 kw.-hr., indicating a decrease of about 3.9 per cent during 1921. This decrease was due to curtailed industrial energy requirements, resulting from the industrial depression. However, new residential consumers added during 1921 served to lessen the effect of the general slump in energy output.

On the other hand, the gross revenue in 1921 is estimated at $944,400,000, indicating an increase of $61,650,000, or 7 per cent over 1920. For the first time data are available showing the annual operating and maintenance expenses of the industry. Returns from 55 per cent of the installed rating of the country indicate that the total operating and maintenance expenses, exclusive of interest, taxes, depreciation or sinking fund, were $432,400,000 during 1921, against $440,000,000 during 1920. An increased revenue and decreased expenses point decidedly in the right direction.

TABLE I—CENTRAL STATION RETURNS FOR TWENTY-FOUR MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase
Mar.	76	2,806,609	2,989,581	-6.1	70	$55,513	$49,071	13.3
April	77	2,675,949	2,895,067	-7.0	72	55,326	49,064	12.8
May	77	2,668,457	2,889,174	-7.6	72	53,901	47,932	12.6
June	77	2,686,479	2,872,900	-6.4	70	52,385	47,977	9.3
July	77	2,706,016	2,949,132	-8.2	70	50,747	49,195	3.4
Aug.	77	2,839,498	3,041,927	-6.7	70	51,931	50,848	2.1
Sept.	77	2,848,212	2,937,339	-3.0	70	54,501	52,955	2.9
Oct.	76	2,997,133	3,045,696	-1.5	71	57,340	55,599	3.1
Nov.	77	3,006,349	2,969,175	1.3	71	61,059	58,381	4.6
Dec.	77	3,124,073	3,024,374	3.3	71	64,088	61,420	4.4
		1922	1921			1922	1921	
Jan.	78	3,102,079	2,843,201	9.1	71	65,669	61,366	7.0
Feb.	77	2,861,542	2,554,282	12.0	72	61,121	57,112	7.0

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
					1921	1920	1921	1920	1921	1920
Mar.	52	18,757	17,248	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	52	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	52	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	53	18,836	19,089	-1.3	56.2	62.5	20.4	21.6	45.0	50.9
July	52	18,633	20,964	-11.1	56.8	65.9	20.6	20.2	43.0	52.6
Aug.	53	19,301	20,900	-7.6	56.2	63.8	22.3	22.2	44.5	52.3
Sept.	53	19,765	21,359	-7.5	54.1	60.3	20.8	22.1	47.3	54.7
Oct.	54	19,828	22,231	-10.8	51.6	60.8	21.3	20.9	45.6	50.8
Nov.	55	19,692	21,773	-9.0	49.9	58.9	23.1	23.3	43.4	50.5
Dec.	55	21,065	22,347	-5.7	47.8	55.9	26.9	29.3	46.1	49.2
		1922	1921		1922	1921	1922	1921	1922	1921
Jan.	55	20,005	20,343	-1.7	45.7	52.7	23.0	23.9	41.2	42.3
Feb.	54	19,067	19,407	-1.8	46.1	51.7	26.6	27.1	41.2	42.3

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWENTY-FOUR-MONTH PERIOD

	Month	Percentage of Installed Ratings Represented	New England States 1921 Thousands	New England States 1920 Thousands	New England States Per Cent Increase	Percentage of Installed Ratings Represented	Atlantic States 1921 Thousands	Atlantic States 1920 Thousands	Atlantic States Per Cent Increase	Percentage of Installed Ratings Represented	North Central States 1921 Thousands	North Central States 1920 Thousands	North Central States Per Cent Increase	Percentage of Installed Ratings Represented	South Central States 1921 Thousands	South Central States 1920 Thousands	South Central States Per Cent Increase	Percentage of Installed Ratings Represented	Pacific and Mountain States 1921 Thousands	Pacific and Mountain States 1920 Thousands	Pacific and Mountain States Per Cent Increase
KW.-HR. OUTPUT	Mar.	80	205,348	230,309	-10.8	81	1,029,120	1,119,428	-8.1	72	894,500	941,893	-5.0	59	139,381	136,017	2.4	83	538,260	561,934	-4.2
	April	80	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	71	828,457	894,028	-7.3	59	132,075	135,421	-2.5	89	555,048	586,894	-5.4
	May	81	191,141	219,298	-12.8	78	934,973	989,408	-5.5	71	819,506	899,657	-8.9	59	136,573	138,416	-1.3	91	586,264	642,495	-8.7
	June	80	192,007	219,476	-12.5	78	940,443	1,003,727	-6.3	71	806,270	880,934	-8.5	60	136,011	129,120	5.3	92	611,128	639,637	-4.5
	July	80	187,622	218,995	-14.3	77	934,822	1,026,390	-8.9	71	804,009	884,572	-9.1	60	140,795	141,450	-0.6	92	639,768	678,725	-5.7
	Aug.	79	205,351	224,324	-8.5	78	992,681	1,054,124	-5.8	71	848,803	923,210	-8.1	60	147,967	154,353	-4.1	93	644,696	685,916	-6.1
	Sept.	79	221,364	223,269	-0.8	78	1,004,252	1,051,268	-4.5	71	851,671	886,370	-3.9	60	149,758	151,680	-1.2	93	621,167	624,752	-0.5
	Oct.	79	249,202	221,929	12.1	78	1,103,525	1,121,676	-1.6	71	919,514	930,236	-1.1	60	154,266	156,713	-1.5	94	570,626	615,142	-7.2
	Nov.	79	247,119	215,565	14.6	77	1,128,453	1,112,914	1.4	71	913,142	908,121	0.5	60	154,125	150,976	2.0	94	563,510	580,124	-3.1
	Dec.	79	253,206	216,717	16.8	78	1,196,724	1,150,695	4.0	71	948,909	925,346	2.2	61	153,549	150,920	1.7	93	571,685	580,696	-1.6
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan.	81	253,217	203,843	24.0	81	1,182,389	1,071,994	10.2	71	946,627	859,191	10.2	60	156,540	141,937	10.3	93	563,306	566,236	-0.5
	Feb.	82	230,875	182,068	26.8	81	1,077,631	957,113	12.6	68	867,475	778,625	11.4	60	145,052	131,937	9.9	93	540,509	504,539	7.1
REVENUE			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Mar.	80	$5,784	$5,566	3.8	72	$21,822	$18,934	15.3	58	$15,853	$14,103	12.4	59	$3,747	$3,246	15.5	83	$8,307	$7,222	15.0
	April	80	5,665	5,554	2.0	72	21,504	18,609	15.8	58	15,506	13,822	12.2	58	3,744	3,312	13.2	89	8,817	7,767	13.6
	May	81	5,362	5,342	0.4	72	20,795	17,613	18.0	58	14,866	13,558	9.8	59	3,516	3,179	10.7	91	9,362	8,240	13.7
	June	80	5,285	5,397	-2.4	72	20,058	17,438	15.0	58	14,485	13,519	7.1	59	3,536	3,152	12.2	92	9,021	8,439	6.9
	July	80	5,180	5,121	1.1	72	18,798	17,155	9.2	58	14,158	14,689	-3.6	60	3,509	3,145	11.3	92	9,101	8,733	4.3
	Aug.	79	5,297	5,483	-3.3	72	19,050	17,926	6.2	58	14,465	14,594	-0.8	60	3,612	3,536	2.2	93	9,507	9,309	2.1
	Sept.	79	5,694	5,857	-2.7	72	19,992	18,750	6.6	58	15,324	15,192	0.8	59	3,811	3,673	3.7	93	9,680	9,482	2.0
	Oct.	79	6,332	6,072	4.2	71	21,520	20,115	6.9	58	16,098	16,175	-0.4	60	3,920	3,903	0.4	94	9,470	9,354	1.4
	Nov.	79	6,806	6,238	9.1	71	23,282	21,541	8.1	58	17,123	16,954	0.9	60	4,139	4,158	-0.4	94	9,745	9,489	2.7
	Dec.	79	6,987	6,573	6.3	72	25,168	23,519	7.0	58	17,748	17,535	1.2	61	4,234	4,149	2.0	93	9,942	9,644	3.1
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan.	81	7,212	6,582	9.6	75	26,008	23,859	9.0	58	17,780	16,745	6.2	60	4,366	4,222	3.4	93	10,237	9,913	3.3
	Feb.	82	6,758	6,105	10.7	75	23,809	22,015	8.1	55	16,883	16,015	5.4	60	4,115	3,970	3.6	93	9,556	9,007	6.1
OPERATING EXPENSES:			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Mar.	45	$1,576	$1,651	-4.5	58	$7,969	$7,241	10.0	34	$4,570	$4,228	8.2	47	$1,776	$1,514	17.2	80	$2,866	$2,614	9.7
	April	44	1,418	1,479	-4.1	56	7,590	7,168	5.9	34	4,347	4,112	5.7	48	1,567	1,403	11.6	80	2,893	2,479	16.8
	May	48	1,548	1,577	-1.8	53	6,921	6,660	4.0	36	4,274	4,292	-0.4	49	1,563	1,486	5.2	83	2,969	2,713	9.5
	June	45	1,737	1,862	-6.7	53	6,916	6,878	-0.5	38	4,843	5,152	-5.9	56	1,835	1,678	9.4	86	3,565	3,519	1.3
	July	46	1,712	2,077	-17.6	50	6,772	7,111	-4.8	37	4,940	5,800	-14.8	58	1,870	2,039	-8.2	86	3,339	3,937	-15.1
	Aug.	47	1,861	2,088	-10.8	50	6,871	7,131	-3.6	37	5,028	5,793	-13.2	58	1,892	2,003	-5.5	92	3,648	3,884	-6.0
	Sept.	47	2,049	2,262	-9.4	51	6,851	7,294	-6.0	38	5,353	5,687	-5.8	59	1,949	2,184	-10.7	92	3,563	4,032	-11.6
	Oct.	47	2,141	2,095	2.1	54	7,175	7,927	-9.5	37	5,011	6,126	-18.2	59	1,990	2,192	-9.2	93	3,511	3,891	-9.7
	Nov.	49	2,040	1,964	3.8	54	7,103	7,790	-8.8	38	4,992	5,972	-16.4	59	1,931	2,262	-14.6	92	3,626	3,785	-4.2
	Dec.	50	2,075	1,901	9.1	54	7,993	8,378	-4.6	37	5,216	6,205	-15.9	59	1,968	2,161	-8.9	92	3,814	3,705	2.9
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan.	51	2,050	1,800	13.9	55	7,387	7,391	-0.0	37	4,990	5,633	-11.4	59	2,007	2,153	-6.8	92	3,571	3,366	6.1
	Feb.	52	1,956	1,639	19.4	55	7,009	7,192	-2.5	36	4,869	5,286	-7.9	59	1,892	2,068	-8.5	92	3,341	3,222	3.6

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States 1921	New England States 1920	New England States Average for Previous 12 Months 1921	New England States Average for Previous 12 Months 1920	Atlantic States 1921	Atlantic States 1920	Atlantic States Average for Previous 12 Months 1921	Atlantic States Average for Previous 12 Months 1920	North Central States 1921	North Central States 1920	North Central States Average for Previous 12 Months 1921	North Central States Average for Previous 12 Months 1920	South Central States 1921	South Central States 1920	South Central States Average for Previous 12 Months 1921	South Central States Average for Previous 12 Months 1920	Mountain and Pacific States 1921	Mountain and Pacific States 1920	Mountain and Pacific States Average for Previous 12 Months 1921	Mountain and Pacific States Average for Previous 12 Months 1920
Steam Plants:																				
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
October	57.5	68.5	59.6	67.9	51.3	60.9	53.8	57.3	57.1	63.5	57.0	63.4	51.8	59.2	54.0	56.4	47.8	57.5	54.7	58.0
November	55.5	68.9	59.1	68.0	49.0	59.3	53.3	57.5	56.1	58.8	57.0	63.2	45.8	54.3	53.3	56.2	44.9	52.7	53.8	57.4
December	57.0	62.8	58.8	67.5	46.2	53.1	52.8	57.0	49.3	62.3	56.5	63.1	46.0	55.1	52.6	56.2	40.8	48.5	52.8	56.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.8	57.7	58.3	67.5	46.2	52.4	52.2	57.2	45.3	55.5	55.3	62.7	41.8	45.6	51.6	55.4	47.5	47.8	51.8	56.4
February	58.6	54.8	58.7	66.9	44.1	48.9	51.6	57.1	45.9	55.8	53.9	62.5	45.8	54.6	50.7	55.7	43.7	48.0	50.5	55.3
Hydro Plants:																				
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.0	19.9	18.1	19.9	20.8	21.1	21.9	28.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
October	32.0	32.0	26.8	33.4	17.8	22.9	18.1	20.2	20.3	18.1	21.6	20.2	30.0	21.0	28.4	20.9	26.4	23.6	25.9	23.6
November	31.0	31.4	26.8	33.4	16.4	22.1	17.9	20.5	20.9	19.2	21.6	20.1	33.7	26.3	29.0	21.5	25.6	24.6	25.8	23.7
December	30.8	34.3	29.2	33.4	23.4	29.9	18.4	21.8	16.5	27.2	21.3	27.5	33.8	28.3	28.9	21.5	27.9	29.1	26.2	24.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	25.0	19.3	30.0	49.7	16.7	21.4	18.0	21.8	28.9	25.6	22.0	21.1	33.8	28.3	29.2	22.2	26.6	25.9	26.1	24.3
February	29.7	32.8	30.0	47.9	17.2	20.8	17.8	20.8	26.7	23.8	22.4	21.4	37.4	37.7	35.2	33.8	37.8	36.5	26.7	24.2
Combined Systems of Steam and Hydro Plants:																				
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	65.5	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5
October	59.3	67.9	54.2	57.4	47.5	47.8	43.4	46.8	47.3	60.5	47.3	56.9	46.3	52.5	42.7	45.3	37.4	42.7	37.0	42.5
November	51.6	51.6	53.9	56.7	42.9	51.6	43.3	47.5	42.3	57.0	47.2	57.0	48.3	51.3	43.3	45.9	41.9	44.6	37.3	42.8
December	52.4	43.8	53.8	55.8	44.3	53.4	43.4	48.1	43.6	57.6	46.9	57.0	48.0	44.3	43.8	45.8	47.0	43.1	37.9	42.8
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.7	43.1	53.4	54.6	39.9	44.7	43.0	47.8	38.8	43.9	46.2	56.1	40.1	38.6	43.8	45.2	33.5	32.2	38.0	42.3
February	45.3	66.5	53.2	53.3	46.5	50.0	43.6	48.4	44.7	46.6	46.4	55.8	38.6	43.0	43.7	45.7	34.6	34.7	37.7	41.5

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Thinks Viewpoint of Editorial Refreshing

To the Editors of the ELECTRICAL WORLD:

On page 519 of the March 18 issue of the ELECTRICAL WORLD an article appeared in reference to the single versus the double rating of electric motors. I think this article was of exceptional excellence; in fact, it seemed to me to be such an excellent exposition of the fundamentals of proper motor rating that I abstracted it in a letter which I sent to many of our salesmen, giving, of course, due credit to the ELECTRICAL WORLD.

So many of the authors who have written on this subject have overlooked or ignored the real fundamentals of the subject that it was particularly refreshing to note an article which went to the pith of the matter.

FRED M. KIMBALL,
Manager Small-Motor Department.
General Electric Company,
West Lynn, Mass.

Field Tests at 280,000 Volts

To the Editors of the ELECTRICAL WORLD:

I find that an unfortunate slide-rule error was made in the calculations included in my article under the above title in the Feb. 11 issue of the ELECTRICAL WORLD. This error affects the whole of the last two columns of Table I and the last three columns of Table II. I hope you will think the matter of corona loss of sufficient importance to warrant the publication of the corrected tables which are inclosed.

Southern California Edison Co., R. J. C. WOOD,
Los Angeles, Cal. Assistant Electrical Engineer.

TABLE I—TYPICAL EXAMPLES OF CORONA LOSS MEASUREMENTS

Date (1921)	Time*	Barometer (Cm.)	Temperature (Deg. C.)	Weather	Voltage to Neutral (Kv.)	Miles of Circuit	Corona and Leakage (Kw.)	Critical Voltage (Kv.)	Coefficient† (M_0)
9/20	**3:45**	72.3	28	Clear	156.0	7.0	82	138.4	0.906
9/27	10:00	72.2	37	Clear	156.0	12.0	47	146.0	0.985
9/27	**8:00**	71.9	23	Clear	156.0	12.0	73	143.2	0.927
9/29	4:00	71.9	17	Clear	158.5	12.0	179	138.3	0.877
10/8	4:00	72.3	12	Clear	159.0	19.5	619	129.3	0.803
10/8	8:00	72.4	23	Clear	156.6	19.5	249	138.0	0.887
10/8	**7:30**	72.4	19	Clear	164.0	19.5	394	140.5	0.891
10/8	**10:00**	72.3	17	Clear	164.0	19.5	658	133.6	0.843
10/9	2:00	72.4	17	Clear	156.6	19.5	236	138.4	0.872
10/20	**2:35**	72.1	34	Clear	139.5	27.0	0	139.5	0.934
10/4	**8:00**	72.3	17	Cloudy	164.0	19.5	857	129.3	0.816
10/2	**4:00**	72.4	21	Cloudy	163.0	19.5	515	136.6	0.872
10/21	**12 M.**	71.8	16	Cloudy	138.3	27.0	137	128.2	0.812
10/22	6:00	71.9	16	Cloudy	139.4	27.0	45	132.7	0.840
10/23	2:05	72.0	13	Cloudy	142.7	27.0	19	138.3	0.864
10/12	**9:15**	72.0	13	Fog	161.5	19.5	830	127.1	0.794
10/12	**10:10**	72.0	13	Fog	164.0	19.5	726	132.2	0.826
10/12	**11:10**	72.0	13	Fog	164.0	19.5	883	128.6	0.803
10/5	10:00	72.3	17	Heavy mist	159.0	19.5	354	136.7	0.863
10/4	8:00	72.4	17	Heavy mist	159.0	19.5	368	136.2	0.858
9/30	**2:00**	71.8	20	Rain	159.0	19.5	552	131.4	0.843
9/30	**3:00**	71.7	19	Rain	159.0	19.5	526	132.0	0.846
9/30	**8:00**	71.7	17	Rain	161.5	19.5	598	132.6	0.844
10/23	8:30	72.2	12	Rain	138.0	27.0	58	130.2	0.809
10/23	10.25	72.2	13	Rain	141.0	27.0	32	135.3	0.843
10/23	11:40	72.2	12	Rain	141.0	27.0	243	125.2	0.777
10/23	**1:45**	72.1	12	Rain	141.0	27.0	132	129.3	0.803

*Boldface type indicates after midday. †Coefficients in Peek's formula.

TABLE II—CORONA LOSS AT DIFFERENT VOLTAGES

(Length of circuit, 19.5 miles. Frequency, 50 cycles. Date of test, Oct. 12, 1921. Temperature, 11 deg. Barometer, 72.0 cm.)

Time (A.M.)	Voltage to Neutral (Kv.)	Total Loss (Kw.)	Transformer and Line I^2R Loss (Kw.)	Corona and Leakage Loss (Kw.)	Average Charging Current (Amp.)	Loss per Conductor per Mile	Excess Over Critical Voltage (Kv.)	Disruptive Critical Voltage (Kv.)	Coefficient* (M_0)
12.50	124.7	26.4	8	18	11.4	0.308	5.08	119.6	0.742
1.05	116.2	0	7	0	10.5	0	0	116.2	0.721
1.20	133.1	13.2	10	3	12.4	0.051	6.54	126.6	0.785
1.30	139.5	66	11	55	13.1	0.941	8.88	130.6	0.810
1.43	147.9	119	12	107	13.7	1.83	12.38	135.5	0.841
1.55	155.5	264	14	250	14.4	4.28	18.92	136.6	0.847
2.05	158.5	356	14	342	14.9	5.85	22.13	136.4	0.846
Average, excluding first three as being unreliable owing to smallness of losses									0.836

* In Peek's formula.

Proper Rating of Motors Rather a Commercial than an Engineering Problem

To the Editors of the ELECTRICAL WORLD:

Your editorial in the issue of March 18 entitled "A Machine Rating Should Express a Definite Recommendation" does not at all coincide with the views of many of your readers. Your statement that "most of the slow processes of standardization have encountered considerable opposition" does not hold true so far as the standardization efforts of the Electric Power Club are concerned, and it is with this standardization that your editorial principally deals.

Virtually all standardization of apparatus during the past ten or more years has been very harmoniously concurred in by almost all manufacturers, and the handbook of the Electric Power Club is full of rules and recommendations that were passed in most cases unanimously. The one outstanding attempt at a change in standardization that has not been unanimous was the attempt to change from 40 deg. to 50 deg. as the fundamental commercial rating for electric power apparatus. This controversy has been going on since about 1914, and the attempt to change the standard has not been successful because the majority does not believe it is right.

In the third paragraph of the editorial you say: "In the first place, a liberal estimate had to be made of the power required and, secondly, a motor was applied that was ample for its rating." Question: Have you seen more than one out of fifty salesmen that would recommend anything larger than really necessary? Of course, the entire question in the final analysis resolves itself into the fitting of the motor to the job by experience. Every day, however, new experiences must be gained because new power-driven machines are coming into use and new conditions are coming up that require always a safety factor to take care of the changing conditions and machines. There is, therefore, now, and will be present probably forever, the question: "Do you want to operate your motor or other machine at exactly its limit of endurance?" If it has the limit of endurance marked on the name plate, the user will apply it usually

to that limit and expect it to live up to its name-plate marking, and many a time it will be called upon to pull more than its name-plate rating because of unexpected load due to machines or parts of machines getting out of alignment, causing tight bearings, or due to rush work and similar causes.

Do motors need a factor of safety in their rating? Decidedly yes. Just because an electric motor does not blow up when the temperature gets to 51 deg. is not an indication that it is a satisfactory machine to recommend for continuous operation at 50 deg. It is the practice in nearly all engineering work to have factors of safety. The only factor of safety that the 50-deg. continuous-rated motor has is the hope of the manufacturer that it may not burn out in a month or a year, but there is no denying the fact that it has a shorter life than the 40-deg. motor, if both are operated within the limitations of their respective guarantees. The proper rating of electric motors is more a commercial problem than it is an engineering one.

C. H. ROTH,
President.

Roth Brothers & Company,
Chicago, Ill.

North Carolina the Fifth State in Developed Water Power

To the Editors of the ELECTRICAL WORLD:

In your issue of March 18 there appears a digest of data compiled by the United States Geological Survey purporting to show the amounts of developed water power in the various states. In the table accompanying this article North Carolina is credited with a total of 255,843 installed horsepower, of which 126,070 hp. is allocated to public utility and municipal use and 129,773 hp. to manufacturing and miscellaneous purposes.

The North Carolina Geological and Economic Survey has recently completed a detailed study of the power situation in this state, the results of which are set forth in Circular 2 of the survey. In Table I of that circular the total developed horsepower in the state is shown to be 360,000. Of this, 128,092 hp. is allocated to public utility and municipal use and 231,908 hp. to manufacturing and miscellaneous purposes. These figures are substantiated by actual returns from the plants and are certainly correct to within a very few thousand horsepower. The error, if any, is probably in underestimating the total amount.

A part of the discrepancy between the estimates of the federal and state surveys is explained by the non-inclusion in the estimates of the United States Geological Survey of developments less than 100 hp., by omission of the 72,000-hp. plant of the Tallassee Power Company at Cheoah, and by omission of about 5,000 hp. in plants put into operation during the latter part of 1921.

Inasmuch as the allocation of 360,000 hp. to North Carolina would make this state rank fifth instead of eleventh in the amount of developed water power, it seems desirable to call this fact to the attention of readers of the ELECTRICAL WORLD. In this connection it is of interest to quote Warren E. Hall, district engineer of the United States Geological Survey at Asheville, N. C., who states in a letter to the writer: "As a matter of fact, I am convinced that your estimate of 360,000 hp. total is nearer correct than anything yet published."

THORNDIKE SAVILLE,
Hydraulic Engineer.

North Carolina Geological and Economic Survey,
Chapel Hill, N. C.

What Is One Man's Meat Is Another's Poison

To the Editors of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD for Feb. 18, in the article on "Iron Wire Versus Copper," it is noted that "Several cases of unusual failure resulted from short circuits. When such a disturbance occurred several miles from the source of power the protective devices apparently could not clear before the line would overheat from the sudden rush of current."

It may be of interest to some of your readers to know that at least one large power company operating an extensive 25-kv. network uses the current-limiting characteristic of iron wire to secure selective action between fuses and relays. What is one man's meat is another's poison!

To this particular system are connected a number of privately owned lines belonging to resellers whose territory does not warrant the expenditure for lines and substations of the high standard adopted by the power company. These cheaper lines and substations are subject to many failures, as was to be expected. In the majority of cases fuses are installed at the take-off from the main line; in some few cases automatic switches are provided.

When the main line was fed from both ends it was found that trouble on these tap lines would generally result in blowing of the fuses, but would not often trip out the main-line breakers. However, when the main line was fed from one end only, branch-line trouble would generally trip the breaker at the point of supply as well as blow the fuses on the tap, or trip out the oil switch in the customer's substation at the take-off. By inserting a short stretch of iron wire in series with the branch lines at the point of take-off it was found that the value of the short circuits on these could be held down to a figure where there would be sufficient current to clear out the tap line but insufficient current to cause the operation of the relays at the points of supply.

The size of iron wire used is approximately the same as the copper in the tap line in each case; the length of iron wire is from 200 m. to 700 m., in series with each phase of the tap line. The amount of iron wire to be used in each case is dependent on the short-circuit current available at the take-off, the value to which it is desired to limit the current in the branch line and the cross-section of the iron wire.

The iron wire is inserted between the main line and the protective apparatus of the tap line so that flash-overs on switches and fuses are choked down to a low value and do not trip out the main line. If they should occur, however, as stated above, short-circuits on horn-gap fuses are a thing of the past as far as all records show.

On those lines that have been equipped with these improvised iron-wire current limiters phase-to-phase arcs at horn-gap fuses have become a matter of history. Interruptions to the operations of industrial plants owned by important customers arising from branch-line troubles no longer occur. Automatic switches of low rupturing capacity in customers' substations no longer show such signs of distress as formerly. The power company's operating forces place greater reliance in the correct action of the branch-line fuses for clearing trouble than they do in the privately owned automatic switches.

F. M. GILLESPIE.

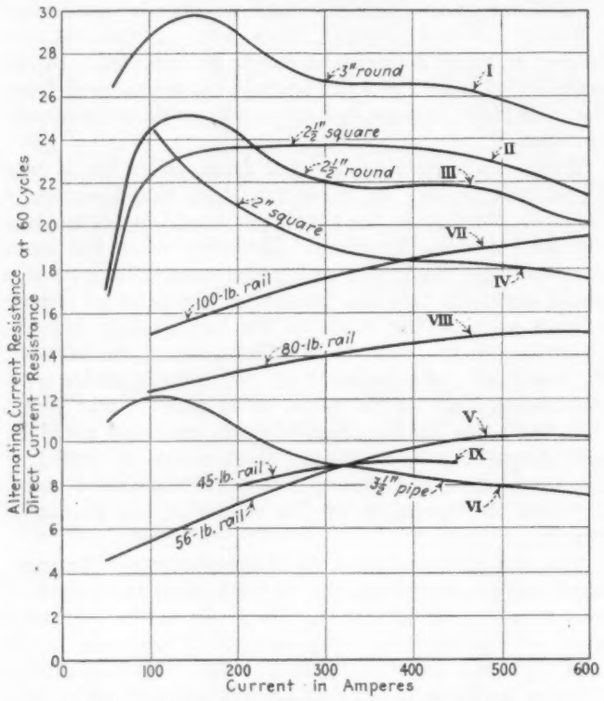
Barcelona, Spain.

Industrial and Station Practice

Installation, Operation and Maintenance of Generating and Distribution Equipment and Economical Utilization of Electrical Energy in Mills and Factories, Including Testing and Repair Methods

Effect of Cross-Section on Impedance of Steel Conductors

SINCE difficulty has been experienced in supporting flexible copper conductors for industrial cranes and heavy traction service and in providing suitable current collectors, some industrial concerns have adopted steel conductors as a solution of the problem. Although such



VARIATIONS OF IMPEDANCE IN STEEL CONDUCTORS WITH CURRENT AND SECTION SHAPE

Curves I, II, III, IV, V and VI from report of the Electric Railway Test Commission of the Louisiana Purchase Exposition; curves VII and VIII from the *Journal* of the Franklin Institute; curve IX from Foster's Handbook.

conductors have come into almost general use for direct-current cranes and traction service, careful consideration has to be given to their impedance when alternating-current service is employed. This characteristic depends on the permeability of the steel, the current density and the cross-section shape of the conductor that is being considered.

The effect which cross-section has on impedance is shown by the accompanying tables for various shapes of commercial steel.

The methods of using copper crane conductors are well known and need no description. The general type depends upon a wire heavily strain-insulated at each end of the runway with diverse kinds of intermediate supports and a trolley-wheel collector with a spring and upward contact. With steel conductors it is possible to use a heavy contact shoe on cranes and depend solely on gravity for contact pressure. Moreover, with rigid members end strains can be eliminated.

Although there seems to be a prejudice against their use, the number of alternating-current industrial cranes is increasing, and the following data are intended to give an approximation of the impedance of commercial steel in view of its very successful use with direct current.

Copper loses its efficiency as a conductor of alternating current as the frequency and cross-section increase. Owing to the skin effect the maximum size of copper wire recommended is 800,000 circ.mil for 60 cycles and 1,250,000 circ.mil for 25 cycles. With steel the skin effect is very much greater, and it has been found that the effective depth of penetration is 0.08 in. for 25 cycles and 0.045 in. for 60 cycles. The following formula has been used to translate data from one commercial frequency to another:

$$\frac{\text{Impedance 25 cycles}}{\text{Impedance 60 cycles}} = \sqrt{\frac{25}{60}}$$

The ratio of alternating-current resistance is a function of the ratio of area to perimeter of the conductor.

IMPEDANCE OF STANDARD COMMERCIAL STEEL SECTIONS

	Weight per Foot	D.C. Resistance per 100 Ft.	60-Cycle A.C./D.C. Resistance	60-Cycle Ohms per 100 Ft.	25-Cycle A.C./D.C. Resistance	25-Cycle Ohms per 100 Ft.
A. S. C. E. Rails:						
100-lb., 5½-in. x 5½-in.	33.3	0.00100	18.00	0.0180	11.60	0.0116
80-lb., 5-in. x 5-in.	26.7	0.00125	15.00	0.0187	9.67	0.0121
70-lb., 4⅝-in. x 4⅝-in.	23.3	0.00143	14.40	0.0205	9.30	0.0133
60-lb., 4½-in. x 4½-in.	20.0	0.00167	12.10	0.0202	7.80	0.0130
50-lb., 3½-in. x 3½-in.	16.7	0.00200	11.00	0.0220	7.10	0.0144
40-lb., 3⅓-in. x 3⅓-in.	13.3	0.00250	9.62	0.0241	6.22	0.0150
35-lb., 3 5/16-in. x 3 5/16-in.	11.7	0.00285	8.85	0.0254	5.70	0.0164
30-lb., 3¼-in. x 3¼-in.	10.0	0.00330	8.17	0.0270	5.28	0.0174
25-lb., 2½-in. x 2½-in.	8.3	0.00400	7.40	0.0296	4.77	0.0191
20-lb., 2⅜-in. x 2⅜-in.	6.7	0.00500	6.45	0.0323	4.16	0.0208
Section Tee Bars:						
3-in. x 3-in. x ⅜-in.	7.80	0.00441	6.74	0.0297	4.35	0.0190
3-in. x 3-in. x 5/16-in.	6.60	0.00512	5.78	0.0296	3.73	0.0190
2½-in. x 2½-in. x ⅜-in.	6.40	0.00535	6.74	0.0360	4.35	0.0230
2½-in. x 2½-in. x 5/16-in.	5.50	0.00625	5.78	0.0360	3.73	0.0230
2-in. x 2-in. x 5/16-in.	4.30	0.00795	5.78	0.0460	3.73	0.0300
2-in. x 2-in. x ¼-in.	3.70	0.00953	4.72	0.0450	3.05	0.0290
1½-in. x 1½-in. x ¼-in.	2.47	0.01370	4.15	0.0570	2.68	0.0370
1½-in. x 1½-in. x 5/16-in.	1.94	0.01760	3.37	0.0590	2.17	0.0380
Angles:						
3-in. x 3-in. x ⅜-in.	7.20	0.00475	6.35	0.0302	4.10	0.0194
3-in. x 3-in. x 5/16-in.	6.00	0.00562	5.40	0.0304	3.48	0.0196
3-in. x 3-in. x ¼-in.	4.90	0.00695	4.33	0.0300	2.80	0.0194
2½-in. x 2½-in. x 5/16-in.	5.00	0.00685	5.40	0.0370	3.49	0.0225
2½-in. x 2½-in. x ¼-in.	4.00	0.00840	4.33	0.0362	2.80	0.0233
2-in. x 2-in. x 5/16-in.	3.90	0.00870	5.40	0.0470	3.48	0.0303
2-in. x 2-in. x ¼-in.	3.20	0.01060	4.33	0.0460	2.80	0.0297
1½-in. x 1½-in. x ¼-in.	2.86	0.01190	5.10	0.0610	3.29	0.0394
1½-in. x 1½-in. x 5/16-in.	2.34	0.01450	4.13	0.0600	2.66	0.0387
1¼-in. x 1¼-in. x ¼-in.	1.92	0.01780	4.04	0.0720	2.60	0.0465
Flat Steel:						
3-in. x ½-in.	5	0.00667	7.71	0.0514	4.97	0.0332

Obviously, as in busbars, a thin, flat conductor would be most efficient. But, since the mutual inductance of mutually perpendicular surfaces is zero, a T or angle shape should be almost as efficient. The following empirical formula has been evolved to meet average conditions:

$$\frac{\text{A.C. Resistance}}{\text{D.C. Resistance}} = \frac{K \times \text{area (sq. in.)}}{\text{Perimeter (in.)}} = \frac{K' \times \text{area (sq. cm.)}}{\text{Perimeter (cm.)}}$$

The average values of K and K' for different shapes of commercial steel are:

	K	K'		K	K'
100-lb. rails	44	35.2	Smaller rails	36	28.8
80-lb. rails	40	32.0	Angles and T's	36	28.8
60-lb. rails	36	28.8			

For convenience the accompanying table has been worked out based on average values of the ratio of alternating-current resistance to direct-current resistance. The direct-current resistance for steel is for an average value 12.2 times the equivalent sections of copper, or .01 ohm per 100-ft. length and 1 sq.in. of cross-section.

The value of impedance depends on the current density in the steel section. Experimental data have been plotted from actual results, and the manner in which this ratio varies with the current is shown in the accompanying curves.

As crane runways are not usually of great length, extreme accuracy of calculation is not required and the mutual inductance at spacings used in practice is neglected in this article. But remembering that the torque of induction motors varies as the square of the impressed voltage, we are concerned with maximum value of impedance. It may be desirable in some cases where steel conductors are used to add auxiliary feeders for a part of the runway.

L. S. LOOMIE,
Electrical Engineer.

New York, N. Y.

Starting Generators for Operation as Synchronous Condensers

IN OPERATING generators as synchronous condensers for power-factor and voltage regulation some trouble may be encountered in starting them inductively. A turbo-generator is apt to be more difficult to start inductively than the ordinary type of generator on account of the high speed and solid rotor construction. Because of the high synchronous speed a comparatively long acceleration period is required, with resultant heating of armature and starting apparatus. As the maximum speed is approached the high windage loss may even prevent the machine from falling into synchronism. Furthermore, since the rotor is usually constructed so that eddy currents set up by the traveling field can flow freely through it, this fact may tend to prevent acceleration beyond half speed. In case the field winding is short-circuited, the induced current therein may have a similar effect.

From the standpoint of starting torque it would be preferable to have the field switch open during starting, but the high potential induced in the field winding at this time by the traveling stator field is apt to puncture the insulation if the field is not short-circuited. Hence the best plan, as a usual thing, is to short-circuit the field winding at starting; if the machine locks at half speed, the field switch can be opened. In case the machine ceases to accelerate at a point just below full speed, normal direct-current excitation may be applied to bring it into synchronism. The starting voltage should be approximately 25 per cent of the rated voltage. A higher voltage may safely be applied when half speed is reached if there is any tendency for the machine to stick at this point.

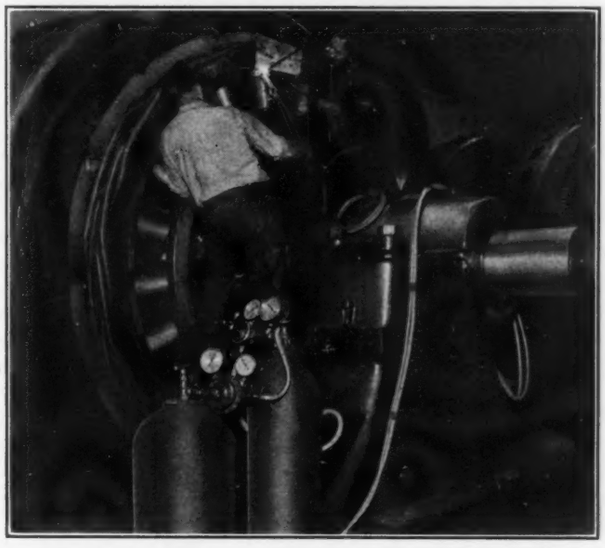
C. R. REID,
Power House Superintendent.

Shawinigan Water & Power Company,
Shawinigan Falls, Que.

Welding Reduces Cost of Repairing Motor Generators

REPLACEMENT or repair of substation equipment when auxiliary apparatus is not available was recently facilitated at the Bryant Street substation of the Market Street Railways of San Francisco by the use of welding, when trouble was experienced with some motor-generator sets.

Starting strains caused a loosening of the bars on the end rings of the squirrel-cage windings of the 2,150-hp. synchronous motors used, causing them to burn off. It was first recommended that the rings be replaced, but when it was taken into consideration that the machine on which the replacements were being made would be out of commission four or five days, it was found that this was impracticable, load conditions being such that all the generators were needed during the peak hours. Consideration was given to removing the field spools from one motor at a time, sending them



WELDING OF END BARS SAVES FOUR-FIFTHS OF REPAIR COST

to an outside shop to be welded. This also proved impracticable.

The work was finally performed by welding. Preparatory to this plates of sheet iron and asbestos to insulate the coils from the heat were made and a blower was arranged to supply a blast of cold air through the coils while the work was in progress. The actual welding was done during off-peak hours. The stator was moved forward by jacking, allowing the squirrel-cage winding to project 2 in. From four to six coils were welded an hour, each coil having four bars. The stator frame moved in both directions to allow welding the bars at both ends.

Each of the five motors on which the work was done was out of operation but four hours, two hours in the morning between load periods and two hours in the afternoon. Approximately twenty hours was required to complete the work on the five motors. The cost for the entire job of welding on the five motors was $100, or $20 per motor. It was estimated that the replacement cost of the worn parts would have been $200 per motor, or $1,000.

According to J. E. Beckman, chief operator for the traction company, welding of the worn parts has im-

proved the operation of the motors more than replacement would have done. Contact is better as a result of the weld than if new parts had been installed and riveted. The motors also start more quickly and with less danger of short-circuiting.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

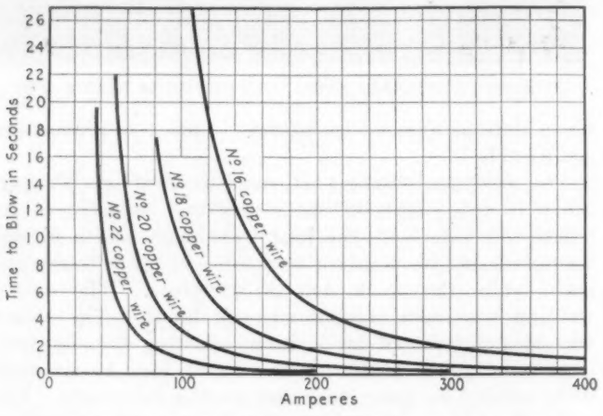
Copper Fuses Used for Transformers

COPPER fuses have been successfully used in 2,300-volt transformer cut-outs for the past two years by the Worcester (Mass.) Electric Company. The time lag of these fuses and their portability in the form of coiled wire are decided conveniences. The size of copper wire used in the cut-outs for the various transformers is given in the accompanying table. Tests under regular operating conditions indicate that the wire as chosen for one transformer should be of such a size that the fusing current will be at least three times the full load current of that transformer. In a case where a smaller wire than this is used the heating caused by normal load currents will oxidize the copper slowly. The blowing periods of the various sizes of wire when tested in the ordinary 2,400-volt transformer cut-out are shown in the accompanying illustration.

SIZE OF COPPER WIRE USED BY WORCESTER ELECTRIC LIGHT COMPANY TO FUSE 2,300-VOLT TRANSFORMERS

Single-Phase Transformers:	Size of Copper Fuse Wire
Under 10 kva	No. 22 B. & S.
10 kva. to 20 kva. inclusive	No. 20 B. & S.
20 kva. to 37.5 kva. inclusive	No. 18 B. & S.
37.5 kva. to 50 kva. inclusive	No. 16 B. & S.
Three-Phase Transformers:	
Under 20 kva	No. 20 B. & S
20 kva. to 59 kva. inclusive	No. 18 B. & S.
60 kva. to 90 kva. inclusive	No. 16 B. & S.

An added advantage where copper wire is used for fusing transformers is that the wire is not crushed under the terminals when it is inserted in the cut-out. This very often occurs with the ordinary fuse wire. To facilitate the work of inserting fuses in transformer cut-outs throughout the system, this company denotes on maps carried by the maintenance forces the size of fuse wire for every cut-out. On 13,200-volt circuits tetrachloride fuses are used.



DISTRIBUTION TRANSFORMERS SUCCESSFULLY FUSED WITH COPPER WIRE

G. M. HARDY,
General Superintendent.

Worcester Electric Light Company,
Worcester, Mass.

Definite Temperature Control Necessary in Babbitt Pouring

THERE is a statement on page 434 of the March 4 issue of the ELECTRICAL WORLD in the article "Suggestions on Rebabbitting Bearings," by M. M. Brown, which I think is too dangerous to allow to be published unchallenged.

In this article, which is otherwise excellent, is the statement "the old rule (which I think is as good as any) says that when the metal is hot enough to blacken a pine stick it is hot enough to pour." This is absolutely true, but the question is, is it cold enough to pour? I think it is generally recognized that the closer we keep our pouring temperature to the solidification point in ordinary babbitts (still considering the intricacies of the pattern and the fluidity necessary to secure good flow) the better will be the bearing. If the bearing is "chill-poured," the initial pouring temperature is not so important as when using higher copper babbitts.

Who knows at what point a pine or birch stick blackens? Who knows the moisture content? I have seen in shop after shop the foundry man use an old charred stick in determining the pouring point, and, by actual measurements, I have found that the temperature covers a range of 75 deg.

TEMPERATURE CONTROL NECESSARY

Good bearing work necessitates the employment of the definite temperature control in pouring, and for this work a base metal (thermocouple) is as good as anything else, considering the low temperatures involved. This instrument is also comparatively cheap.

It is also noted that Mr. Brown states "that sometimes it happens in the manufacture of babbitt that particles of copper and antimony amalgamate into what are called hard points. These are no larger than pinheads and are as hard as steel. If they come to the surface, as the babbitt wears down, they are sure to score the shaft or pin." Unless Mr. Brown specifically refers to the intermetallic compounds due to impurities—for example Fe, which should never be present if the raw materials are chemically controlled—this is not the case. All other hard crystalline bodies, such as Sb, Sn and Cu_6Sn_5, are deliberately put in the bearing, and no babbitt metal would be efficient without these particles. They do not and normally cannot score the shaft and the efficiency of the bearing depends entirely on the presence of these minute crystals.

Crystals of antimony and tin have a low coefficient of friction and are hard enough to resist wear, but as they are of low density there is a great tendency toward flotation in pouring unless copper is added. By the addition of copper an intermetallic network is formed which effectively entangles these small crystals throughout the babbitt, so that no matter how much the bearing is scraped the new surface will have these small crystals present. It is the contact with these crystals upon which the efficiency of this type depends.

The softer matrix is for the purpose of holding the journal and allowing the crystals to adjust themselves against the journal, thus preventing scoring. Of course, these remarks hold only when first starting the rotation of a journal and before an oil film is built up. After an oil film is built up the material of the bearing makes little or no difference provided that the oil film is not ruptured. However, the microscopic structure of the bearing metal does have a bearing on the ability of

metal to create and maintain an oil film, and the low soft parts in which the crystals are embedded act as molecular oil pockets.

KARL F. SMITH,
General Inspector of Naval Aircraft.
McCook Field, Dayton, Ohio.

Scheduling Departure of Meters by Portable Truck Saves Time

MUCH time is saved in drawing meters and repaired appliances from the stockroom of the Hartford (Conn.) Electric Light Company by a system recently adopted. Through the operation of this system each

METER AND APPLIANCE ASSEMBLY TRUCK SAVES MORE THAN A HALF HOUR DAILY PER MAN

meter installer or delivery man finds a segregated group of meters or appliances waiting for him when he reports for work. The scheme saves from thirty to fifty minutes a day for each man on this class of work. This system replaced another less efficient scheme in which orders to install meters, etc., were written at any and all times of the day and marked for immediate execution. This made it impossible either to group the work efficiently or to start the delivery service out on time. Orders received up to 7 a.m. or 1 p.m. were written hurriedly and usually were given to an employee going in the general direction of the lighting department. The result was much disorganized rushing about and frequent mistakes.

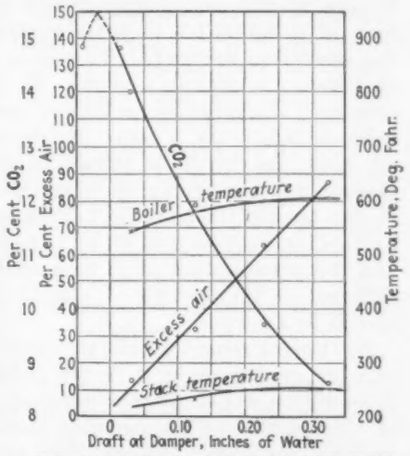
The first step in revising this system was to require that all orders for afternoon deliveries be written and in the hands of the lighting department by 10:30 a.m. All orders for morning work were required to be complete and in the department's hands by 3:30 p.m. of the previous day. This allowed sufficient time for grouping the orders in trips, considering both location and the work to be done. Under this arrangement the grouped orders are turned over to a clerk in the meter stockroom, who assembles all the necessary meters, fuses, lamps, appliances, etc. A four-wheel truck frame was purchased and fitted with shelves as illustrated. Five of these, 5 ft. long and 3 ft. wide, are provided, the vertical spacing between shelves being 12 in.; the shelves are of oak, shellacked, and are carried by 1½-in. x 1½-in. x ⅛-in. angle irons, with 1-in. x ¼-in. diagonal bracing at the ends. Movable wooden barriers ⅞-in. thick x 2¾-in. high are provided to subdivide further the shelves. Metal clips bearing the installers' names are hung on the angle-iron supports.

On the truck the stock clerk lays out each man's apparatus in separate compartments as called for by the collection of orders grouped in trips. This truck with its load is sent to the elevator loading platform at the company's Pearl Street office building at 6:55 a.m. and 12:55 p.m., and in this way men reporting for work at 7 a.m. and 1 p.m. find everything arranged and ready for loading upon road trucks.

H. L. THOMSON,
Superintendent of Lighting Department.
Hartford Electric Light Company,
Hartford, Conn.

Excess Air Causes Serious Losses in Boiler Plants

PERMITTING more air to enter a furnace than just enough to allow complete combustion to take place causes a loss in over-all economy that may amount to 2 per cent or more. As shown in the accompanying chart of a test on a boiler using fuel oil, the amount of excess air is drectly related to the percentage of CO_2 obtained. The higher the CO_2 content of the flue gases and the lower their temperature the better the boiler efficiency will be. The CO_2 obtained depends upon the draft and the condition of the boiler setting. If there are air leaks in the setting or around the doors, excess air is admitted and causes low CO_2 and hence a fuel loss. If the boiler settings are tight, it has been found that good CO_2 can be obtained for any load on the boiler or for any number of fires if the draft is regulated closely. Increasing the CO_2 content from 12 per cent to 14 per cent with the same flue-gas temperature, means a reduction of more than 2 per cent in the fuel consumed.



THE AMOUNT OF EXCESS AIR GREATLY AFFECTS THE BOILER EFFICIENCY

The flue-gas temperature depends upon the draft, the load, the air leaks and the cleanliness of the boiler, both inside and out, and the conditions of the baffles. With 14 per cent CO_2 a flue-gas temperature of 500 deg. Fahr. instead of 600 deg. Fahr. means a saving of about 2½ per cent of the fuel.

Therefore, if the CO_2 content is increased from 12 per cent to 14 per cent by keeping the settings tight, regulating the draft closely and cutting out the smoke, and if the baffles are kept in good shape, the draft set properly and the flue-gas temperature kept low it is possible to make a gain in efficiency of more than 5 per cent.

Southern California Edison Co., W. E. THOMSON,
Los Angeles, Cal. Steam Plant Engineer.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

The Curse of "Canned Speeches" at Our Conventions

With the Approach of the N. E. L. A. Convention at Atlantic City This Article by "Kassandra" Is Particularly Pertinent at This Time

RECENTLY I was dining with three good lawyers and was interested to hear them discuss some of their confrères. Some men were good lawyers because they could dig up the law and write an excellent brief showing what the law was. Others were good because they could sit down with a client in their office and give good advice. Still others were good as trial lawyers or jury lawyers in conducting a case before the jury.

Then they went on to a particular friend of theirs who did a good deal of trial or jury work but was not particularly successful in winning his cases. They all knew the reason, and the scorn with which they put it was illuminating: "He *reads* his speeches to the jury." That he looked up from his manuscript at the jury, that the inflections of his voice and his gestures were good, were only a slight excuse for this cardinal crime of inefficiency in winning over the jury to his way of thinking.

Now the application of this to the electrical business is seen in our conventions, where too often the chairman of a committee presents a report and reads it to the assembled members. To read a report to a number of persons is almost a crime. It is a waste of their time even if a large percentage of them have come to the meeting solely for a nap. No report should be read. At most the chairman should be allowed perhaps ten minutes for presenting its salient points, and even then he can accomplish more by talking about it than he can by reading any portion of it. The writing of a report and the presentation of it to a convention are just as different as the writing of a legal brief and making a speech to a jury.

No lawyer would think of reading his brief to the jury or even reading it to the judge. He knows that if he did he would never win a case. When a chairman of a committee or its members spends valuable time in working up a good report, they should realize that a little extra time devoted to presenting it properly before the convention will double or triple its value.

Some reports are merely collections of statistics and should be presented by title only. They should be made available in the bound volumes or in separate copies, but there is no use whatsoever in reading them, nor is there any use in *reading* any report. If presented otherwise than by title, it should be talked and not read.

That each one of the audience loses or wastes only a little time while he sits before the reader of a report is no excuse when it is remembered that the sum total of all the time thus wasted would balance the giving of two or three days by the chairman of the committee or whoever presents the report to learning how to present it efficiently, just as a lawyer who is going to present a case to a jury or to a judge devotes a considerable portion of his time to learning how to present it efficiently.

Electrical men attend the N. E. L. A. convention in order that they may have a few days for the intensive interchange of ideas and to broaden and readjust their viewpoints on new problems and developments in the industry. Many of these men have spent considerable sums of money and several days' travel to gain the advantages of convention conferences. Their time is valuable and should not be taken up by the unnecessary reading of written reports which they can study to much better advantage when they get back home.

Connecticut Town Guarantees Return on Rural Line Extensions

THE town of Bloomfield, Conn., and the Hartford Electric Light Company have recently agreed upon a policy of financing rural line extensions which is believed to be of general application in cases where the municipality will agree to meet the extra cost of service above revenue by drawing upon the tax levy. Bloomfield is a community lying about four miles outside Hartford, with a surrounding agricultural district which was very desirous of obtaining electric service on reasonable terms. Conferences between the company and town officials resulted in a town meeting at which the citizens voted to guarantee a return upon certain extensions, making up from the tax levy the difference between the income received for the sale of energy including a monthly minimum guarantee by each customer and a total sum representing the company's estimated cost of service over all.

Four line extensions (2,300-volt, single-phase) were determined upon by the board of selectmen and the company under the agreement. The estimated construction costs of these were, omitting cents, $317, $494, $1,625 and $6,767, or a total of $9,205. On the basis of turning its capital on the average once in three years, the Hartford company agreed to make these extensions if the town would guarantee an annual income from them of $3,068 for three years, payable in thirty-six monthly installments of $255 each. Before beginning construction, the company and the board agreed that the latter should canvass the sentiment of residents in the districts to be reached by the new service and secure the signatures of at least forty proposed customers to an individual agreement by which each promises to pay the company $30 per year for three years in equal monthly installments of $2.50 each and further to pay the company the regular meter rates as filed with the Public Utilities Commission.

Adjustment with the town by the company is to be made annually to give the town credit for amounts

used by any individual customers in excess of the monthly minimum contracted for by the individuals. In case additional customers desire to secure service from these extensions after construction of the lines, they are referred by the company to the board of selectmen, which discusses with applicants the terms under which they may share in the cost of providing the service, the usual rates of the company also of course being applied to service rendered.

Central-Station Manager Lends His New Bungalow as "Electrical Home"

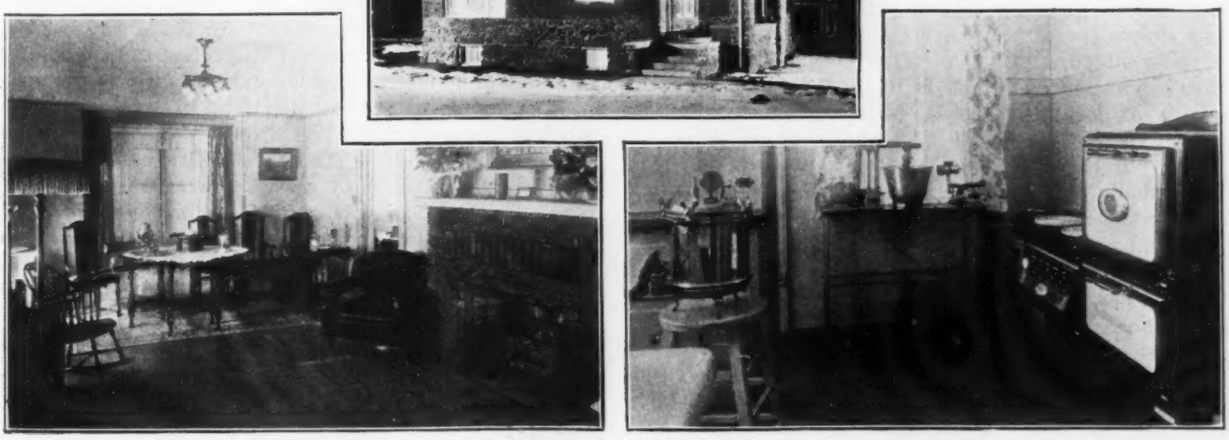
FROM Boulder, Col., comes an unusually interesting story of an electrical home demonstration carried out in a house designed and built especially for a practical central-station man. To F. S. Henderson, manager of the Western Light & Power Company at Boulder, the credit is due for "putting over" the project, for it was his home that he offered to the electrical interests of the community to tell the story of "the modern home" for the first time in Colorado.

Mr. Henderson designed and built the home himself and put some of his own furnishings and equipment in it during the display. As the central-station manager in that city, he invited the contractor-dealers to co-operate in the wiring, furnishing and display of the home. The literature distributed during the exhibition referred to all individuals and concerns, including the furniture house and musical dealer, as making the exhibition possible.

The home was opened for display March 3 and closed March 12. With the exception of two Sunday nights, it was open for inspection daily from 1 p.m. to 10 p.m. The largest one-day crowd was 524, and the last Sunday afternoon 304 people entered the house. A severe snowstorm and windstorm for two days did not deter 250 people from seeing the house. Considering the population of Boulder as 15,000, the total attendance of 2,629 was approximately 18 per cent of the population. The advertising to secure this attendance cost about $350.

According to Mr. Henderson, the most valuable publicity secured was that resulting from the co-operation of the Boulder Woman's Club, which provided two of its members each day to serve as hostesses. Although they were not in a position to explain the features found in the home, they gave a personal touch to the affair, meeting the people at the door and making them feel at home.

The success of the Boulder home is indicative of the benefits which will come in other parts of Colorado through the electrical home movement. With many of the state newspapers showing an interest, it is believed that following the exhibition in Denver additional homes will be featured during 1922 in at least five other Colorado cities.



VIEWS OF BOULDER, COL., CENTRAL STATION MANAGER'S ELECTRICAL HOME

What Other Companies Are Doing

Illinois.—Public utilities companies will spend $75,000,000 in plants and equipment in Illinois this year because of their confidence in the business and industrial outlook. These figures were quoted by R. V. Prather, secretary of the Illinois State Electric Association, in his report at the annual convention of this organization at Chicago, March 15.

Boston, Mass.—A very successful series of lectures by employees on the history, growth and service of the Edison Electric Illuminating Company of Boston is now under way in the Metropolitan and suburban territory served by this utility. With a little coaching and a full assortment of lantern slides, employees are speaking before "capacity houses."

Omaha, Neb.—The Nebraska Power Company recently launched a customer-ownership campaign in its territory. The company is offering the stock to customers either for cash or on partial payments, and in the latter case the alternative is offered of withdrawing from the deal, the company refunding the money paid in with interest at 6 per cent.

Bellingham, Wash.—A continuation of the program of the Northwest Electric Service League to bring the idea of proper electrification of the home before building contractors and architects was accomplished by means of a joint meeting of the electrical men and those interested in building construction at Bellingham, April 12. H. B. Sewall, Bellingham manager of the Puget Sound Power & Light Company, spoke on co-operation between the architects, electrical contractors and others engaged in residence building.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development, the Business and Economic Problems of the Manufacturer, Jobber, Agent, Contractor and Dealer

The Safety, Suitability and Soundness of Domestic Appliances

By Charles Edward Lucke, Ph. D.
Professor of Mechanical Engineering, Columbia University, New York City, Consulting Engineer Hoover Suction Sweeper Company

THE future of household electric appliances hangs on just one point, acceptably good service, or, rather, the highest possible quality of service. If these appliances are really good, each in its own proper way, their use will increase and as they wear out they will be replaced. If they are not really good, however, while many homes may buy one for trial, they will soon be discarded and will never be replaced. If these appliances are satisfactory, capital invested in the industry of appliance production will be safe, and so also will capital invested in the extension of electric distribution or increase of central-station capacity. If the household appliances are not satisfactory, all such capital will be at least unsafe, if not actually lost.

The public has accepted in principle the electric heating appliance, the curling iron, chafing dish, toaster and coffee pot, flatiron, and under proper conditions the room heater and cooking range. The public has also accepted in principle the electric power appliance, the fan, clothes washer, clothes ironer, dishwasher, vacuum cleaner and refrigerator. But acceptance in principle is not permanent acceptance in fact unless these things are right and suitable for the purpose intended. Continued use depends primarily on this service factor, which is in turn dependent on the quality of design, materials, workmanship and production of the appliance with its electrical connections.

The purchaser of an electrical household appliance is normally not skilled in electricity, in mechanical construction or in machinery. Incapable of passing judgment on technical matters of quality and not justified in paying for advice, the purchaser, usually a woman, has been forced to make selections on other grounds. Under such conditions, alluring advertising, persuasive salesmen, trick demonstrations, beauty of appearance in form, finish or color, and price or terms of payment are factors more apt to control selection than real merit in the appliance contributing to good service.

There seems to be but one way available for the correction of the defects in this situation as it exists—defects that threaten equally the stability of the interests of housekeeper, appliance manufacturer and central-station company. That way involves, as a first step, the establishment of some acceptable and practically attainable standards of quality, and with it, as a second step, the setting up of some means of enforcing those standards.

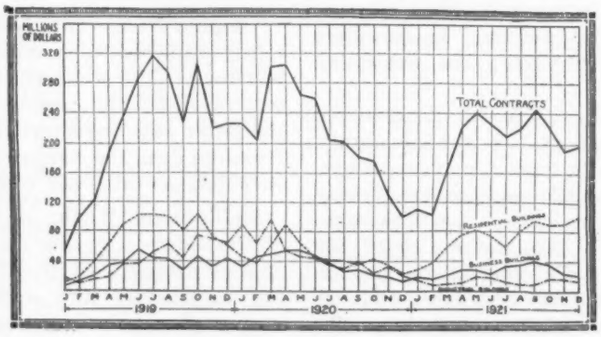
On the problem of arriving at proper standards there is much that can be said, based on experience that should prove useful. Here it is necessary to be specific, as the standards problem for one appliance is quite different from that for another, though, of course, certain things, like connections, are common to all. Plugs, cord connections and switches now in use, however safe they may be from the point of view of fire risk as to adequacy of insulation, are in all important respects normally bad. They do not give good service because they are mechanically imperfect and often unsuited to the service in other respects. This is not due to any lack of knowledge as to how such things should be made, but primarily because price controls, and the cheapest thing that authorities will accept is what is used.

Switches should be part of any appliance—switches that are convenient, and strong enough even to stand as much abuse proportionately as an automobile axle. Switch breakage, cord joint failure, plug or socket insulation breakage, loose screws and a hundred other mechanical defects can easily be eliminated, no matter how ignorant or careless the operator, if standards are established to prevent the sale of what is flimsy or dangerous.

No better proof of this possibility could be cited than the automobile of today, operated normally by people with no knowledge of machinery or with the little that is more dangerous than none, yet with no major failures worth mentioning except in collisions. In the case of the automobile no service quality standards were necessary nor was there need of a system of enforcement. Public observation itself was sufficient, because he who rides can see. Cars that fail to come home are observed by all, and their sale automatically stops.

In the case of the electric household appliance the

Trend of Building Operations



THIS chart, showing the trend of industrial, business, residential and total building operations by months for three years offers further encouragement to the electrical industry. Total contracts for the last six months of 1921 are well above those for the same period of 1920 and many of these buildings are coming into the electrical stage of construction now.

conditions are different. One's home is not open to the inspection of every other owner as is the family automobile; the defects of the housekeeper's appliances are for psychological reasons more likely to be concealed even from intimate friends, than to be aired or explained. Therefore the creation of protective standards is not only important but necessary to a degree hardly equaled elsewhere.

Considering the appliance standards problem, so far as procedure is concerned, independent of the basic question of connections standards, attention must be directed toward the purpose of the appliance and the measure of attainment of that purpose. It should be accepted as an axiom that no measure of quality applied by test or otherwise should be accepted unless it is a direct measure of some necessary service quality, except when a direct measure is impossible or undiscovered. In this case an indirect measure is permissible and is acceptable in proportion as it bears on utility or measures of the appliance value for the purpose intended. Standards must be based on these direct and indirect measures of service quality, because it is obvious that a standard for which there is no measure is not a standard at all.

It must also be regarded as axiomatic that no standards, however desirable they may seem from the standpoint of quality measuring, can be accepted when they have the effect of preventing or even hindering legitimate progress in developing improved designs by invention or research.

Proceeding from these broad principles, applicable to all appliances, it is possible to set down some more detailed principles, also of general application. Standards and measures of standards for any appliance must be concerned with four main subdivisions of the general aim of achieving greatest service quality. These four main subdivisions are:

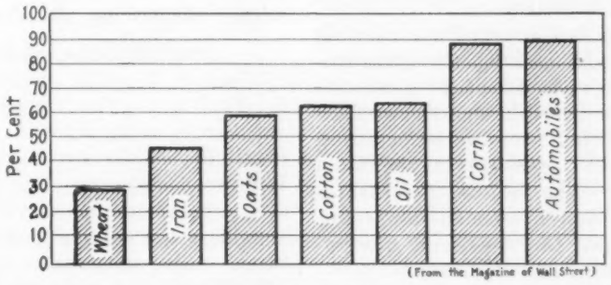
1. *The Principle of Safety or Hazard.*—Appliances should be as safe as possible against risk of fire and personal injury in the house.

2. *The Principle of Domestic Suitability.*—Appliances should not require reorganization of home or injure the furnishings of a home or the clothing of its inmates; should be adapted to use by a woman and should be equally adapted to all types of homes from the largest to the smallest, to the most or the least intelligent people, to the apartment or the house with stairs—unless, of course, the appliance is intended for some special domestic condition, in which case its limitations cannot be made too plain.

3. *The Principle of Structural Soundness or Reliability.*—Appliances should not be flimsy, or too quickly require adjustments that the unskilled cannot make, or too quickly wear out, or suffer from the loosening of fastenings. Certainly they should not cease to function until really worn out or quickly lose effectiveness.

4. *The Principle of Effective Functioning.*—Each type of appliance is intended to do something, and the effectiveness or efficiency with which the aim is accomplished is probably the most important of all its features, though by no means the only basis on which judgments of service quality may be formed.

America's Contribution to the World's Production



WHEN everybody is thinking about the development of export trade this chart is of unusual interest as it shows the strength of our position. Of the seven items shown, with the exceptions of wheat and iron, the United States produces from 60 to 90 per cent of the entire world's supply.

The Price of Cash

IT SEEMS to be hard for a great many people to realize that cash is a commodity and that the price of cash is as fixed and definite as the price of any other goods that are bought and sold. Here is the problem in a thought. Does a cash discount mean what it says, or is it a little matter for juggle and jest, in which the customer stretches his ten days to twenty if he can get away with it?

Consider a typical transaction between a contractor and the jobber. In his warehouse lies a bin of wire and he wishes to sell it. The contractor needs a few coils of No. 14 and asks the price. The jobber quotes him a definite list and a definite discount and offers to sell it to him for the usual terms of credit. That is the price of the goods.

Then comes another and a separate transaction. At the same time the jobber sells this contractor the wire he offers to buy something from him—to buy cash. The jobber knows the contractor has a wad of ready money stowed away and offers to buy some from him. He offers the contractor one per cent discount for delivery of his cash in ten days. That is the price of cash. When the jobber makes his price on the goods and this contractor sends his order, there is never any question as to their cost to him. It is all clear and clean. If the goods are satisfactory, they are paid for at the agreed price. He would never think of deducting a dollar or so just because he thought he could, for when a true man orders goods at a price he pays the bill.

But here's a curious and singular thing: When this same man undertakes to sell cash to the jobber with delivery date stipulated as a part of the price, it is a fair bet that he may ship that cash from five to twenty days late and deduct the price of cash-on-time collected in advance, without a word to the man who gave the order for the cash he's selling.

Day after day to the jobber come checks, big and little, that cannot be accepted and have to be sent back. The money is not due yet for the purchase of the goods, but the jobber has offered to buy cash from these people, with delivery stipulated, and here comes the cash too late, not worth the price quoted and not wanted. A cash discount is the price of cash delivered on the dot.

When the contractor sells cash to the jobber, or to anyone else, the price of cash is always specified and delivery is ever a prime condition of the purchase.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Theory of Distortionless Alternators.—G. SHIMIDZU.—The author derives formulas for calculating the short-circuit current and voltage regulation of the distortionless alternator.—*Journal of the Institute of Electrical Engineers of Japan,* February, 1922.

Electric Drive for Reversing Machine Tools.—A. L. HARVEY.—Many of the machine tools in common use are of such a nature as to require operation in both directions. This may be accomplished by crossed belts, clutches or reversing electric motors. A careful consideration of the various details with respect to their effect on the operation of the machine and its rate of production determines the type of drive to be selected. When this is done properly the result is a more efficient tool, more satisfactory electrical equipment and higher production. This is especially important in the case of the older tools that are changed over to electric drive by the user.—*American Machinist,* March 9, 1922.

Lamps and Lighting

Measurement of Pressures in Vacuum-Type Electric Lamps.—DUNCAN MACRAE.—In making the measurements the tip of the lamp is removed in an evacuated glass system by means of an iron plunger electromagnetically operated. The resulting pressure is measured with a McLeod gage and the pressure in the lamp before opening is calculated. The results of measurements on unflashed, flashed and life-tested lamps are given.—*Paper presented before the American Electrochemical Society at Baltimore,* April 27, 1922.

Better Lighting an Economy Measure.—WARD HARRISON.—In a test recently conducted to determine the actual dollars and cents value of improved illumination it was found that as a result of the installation of a modern system of illumination in one of the departments of the Dover (Ohio) Manufacturing Company production was increased 12.2 per cent, while the increase in the lighting costs amounted to only about 2.55 per cent of the payroll. The results were so satisfactory in this department that company officials purchased the equipment used in the investigation. At their request a complete illumination design was made for the entire plant, and parts of this new system are already installed.—*Iron Age,* April 6, 1922.

Generation, Transmission and Distribution

Improvement of Power Factor.—M. HARLÉ.—Practical directions for bettering power factor by the employment of electrostatic condensers, with numerical and diagrammatic examples from actual experience.—*Bulletin de la Société Française des Electriciens,* Vol. I, No. 10.

Interconnection of Alternating-Current Power Stations.—L. ROMERO and J. B. PALMER.—The purpose of this paper is to show the importance of power-factor phenomena in interconnectors, both on technical and on economic grounds. Formulas for estimating the values of power factor resulting from interconnection are given, and the voltage boost required to transmit power at a given factor is shown. The adequacy of the synchronizing power of a proposed interconnecting line should, if possible, be calculated theoretically before the line is installed, as the result of installing a line with inaccurate synchronizing power might be very costly. —*Engineer (London),* Feb. 17, 1922.

Traction

***The Lancaster-Morecambe-Heysham Electric Railway.*—This branch of the Midland Railway (England) was equipped with single-phase electric traction in 1908 to obtain experience which would be valuable in dealing with the wider problem of main-line electrification. This article gives an account of the failures and modifications which have been shown to be necessary in various parts of the apparatus during the fourteen years that it has been operating. Protective devices,** bonding, power supply and traction equipment are dealt with —*Electrician (London),* Feb. 3 and 10, 1922.

Installations, Systems and Appliances

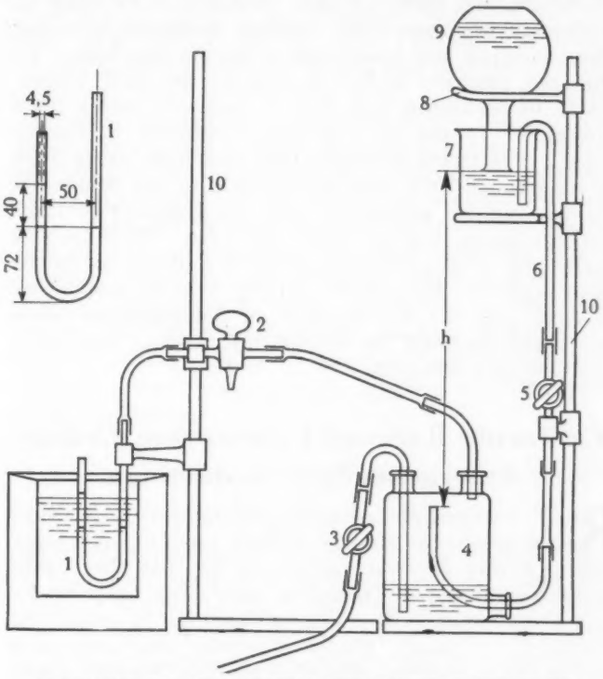
Electric Welding Applied to Steel Construction.—A. T. WALL.—The various methods in which electric welding is being applied to ship construction and the possibility of its use in steel structures are described. Reference is also made to the necessity of taking reasonable precautions in carrying out the work. The author considers the detailed construction of large steel structures, with particular reference to the joints and attachments of the component parts.—*Engineering, (London),* Feb. 24, 1922.

Electricity in the Lace Industry.—J. F. CROWLEY.—The principal features of a lace machine from the point of view of the power engineer are (a) the high starting torque required, (b) the great cyclic variation in the torque, and (c) the delicacy of the mechanism of the machine. As the machine is unusually long, occasionally covering as much as 40 ft., and has heavy reciprocating parts, it must have a steady drive unaffected by causes external to the machine which would tend to produce variations in torque or speed. The electric drive with three-phase motor provides a very good solution.—*Electrician (London),* Feb. 25, 1922.

Selection of Electrical Apparatus for Cranes.—R. H. MCLAIN.—The purpose of this paper is to assist crane designers and electrical engineers in mills and factories to select the proper size and kind of motor by mathematical calculation from given data. It refers particularly to the electric overhead traveling crane. It does not apply to heavy-duty cranes which undergo regular duty cycles or to very small hoists such as the monorail hoist. In discussing the selection of motors, direct-current motors are treated separately from alternating-current motors, as are the calculations for each. —*Journal of the A. I. E. E.,* March, 1922.

Electrochemistry and Batteries

Influence of Low Temperatures on Mineral Oils in Transformers and Oil Switches.—The thickening of oils in transformers and switches has certain disadvantages and dangers which it is the purpose of the article to explain. It is shown that if oil loses its fluidity on account of a considerable drop of temperature, the circulation of the oil is stopped and heat transmission by convection no longer takes place. Experiments were made to determine just what occurs in transformers and oil switches under these conditions. The methods for examining the behavior of oil all possess certain shortcomings. A new method has been deduced from



APPARATUS FOR DETERMINING THE SETTING POINT OF OIL

1—U-shaped test tube. 2—Three-way cock. 3—Drain cock. 4—Woulf's bottle. 5—Cock. 6—Siphon. 7—Glass receptacle. 8—Fork. 9—Inverted bottle. 10—Bracket.

these older ones which seems to work out very satisfactorily. The new method is based on the behavior of oil when it is cooled. The sample of oil is cooled to the desired temperature in a U-shaped test tube and an air pressure of 50-mm. water gage is applied for one minute. The apparatus used is shown in the accompanying illustration. When the pressure is applied it causes the oil to flow. The height to which the column rises is a measure of the consistency of the oil at the temperature chosen.—*Brown-Boveri Review*, January, 1922.

Units, Measurements and Instruments

Oscillographic Investigations of Fields and Emfs. of Induction Motors.—W. STIEL.—The author describes in this paper a long series of exact oscillographic measurements made by him. A standard three-phase induction motor was equipped with a special smooth and laminated rotor, on the circumference of which a small silver ribbon was pasted in the axial direction, connected at each end of the motor shaft to a collector ring. Brushes upon these slip rings were connected to the loop of an oscillograph. The stator of the motor was excited with direct-current, single-phase current, and finally with three-phase current. A small auxiliary motor drove the rotor at a speed varying in the different trials. The resulting oscillograms disclose the influence of the slots in the stator, the shape of the emf. at each moment and the form of the magnetic flux depending upon the connection of the stator winding. In the series of three-phase tests several observations were made with the excited stator and stationary rotor to determine the nature of the so-called revolving field. The author claims that there is in reality no revolving field. The apparently revolving field is due to a configuration of polyphase currents in the windings, resulting in a periodic change of the induction at points on the circumference of the rotor.—*Elektrotechnische Zeitschrift*, Feb. 16 and 23, 1922.

Telegraphy, Telephony and Signals

The Grid Potential of a Triode and Its Measurements.—T. ONO.—The electric field in a triode valve is closely related to the distribution of negative charges in the inter-electrode space, and the potential distribution is determined when the plate potential and the filament temperature are given. In order to understand the behavior of the electronic space charges, the potential of the disconnected grid was measured. Two methods are proposed for its determination, and it is shown that their results coincide. Observations on triodes with different characteristics are described, and the physical phenomena in the bulbs are explained.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1922.

Miscellaneous

The Hydro-Electric Problem in Italy.—DOMENICO CIVITA.—An elaborate treatise filling 134 pages, with many illustrations, tables and charts. Historical and statistical information is followed by a discussion of Italy's hydro-electric enterprises in their technical, legislative, economic and financial aspects. Then the activities of electrical companies in the development of new power resources are reviewed under the following geographic headings: Liguria, Piedmont, Lombardy, Trentino, Venetia, Emilia and Romagna, Tuscany, Marches, Latium and Umbria, Abruzzi, Southern Italy, Sicily and Sardinia. Lombardy leads all the other provinces, with a total capacity installed or in course of installation of 603,000 kw., of which less than one-sixth represent steam plants and 270,000 kw. dates from or after 1918 and thus indicates plants "in construction." Piedmont is next, with 450,000 kw., of which only about 30,000 kw. is steam-generated and 155,000 kw. dates from or after 1918. Then there is a long drop to Venetia, with 281,000 kw., of which 201,000 represents post-1918 figures. The other provinces show much smaller total ratings, but a large degree of activity in hydro-electric development. About 100,000 kw. is being developed in Calabria, at the southern end of the peninsula. Previously Calabria had only 5,000 kw. Liguria has the largest proportion of steam plants, 75,000 kw., which about equals the rating of hydro-electric installations built or building in that province. A total consumption in 1919-1920 for all Italy and for every purpose reaching 3,826,562,180 kw.-hr. is recorded. The population served with energy for lighting is placed at 24,135,383, with an average annual consumption per capita of 12.9 kw.-hr. An outline map in colors shows the voltages, frequencies, interconnections of existing lines and projected interconnections and groupings of plants in the entire nation. The great need in carrying forward the work of hydro-electric development in Italy, the report says, is capital.—*Report presented at annual meeting of the Associazione Elettrotecnica Italiana at Palermo*, October, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

To Discuss Effect of European Conditions on America

"EUROPEAN Conditions and Their Effect on American Business" will be the main topic at the tenth annual meeting of the Chamber of Commerce of the United States, to be held in Washington May 16 to 18.

"In selecting the subject for the convention," a statement issued by the Chamber of Commerce says, "there was a desire to obtain a thorough discussion of world business conditions as well as domestic conditions for use as a basis of judgment in planning measures to insure a continuing future prosperity in the United States. The situation abroad has been constantly changing, and the time has come for a new inquiry into the facts. The biggest question before American business men today is the problem of formulating intelligent plans that may be of assistance in restoring normal economic conditions.

"No plans can be made that do not take into account the European situation, including such problems as the Allied debts, reparations settlements, paper currency issues, exchange fluctuations, ocean shipping, etc."

As in previous years the work of the convention will be done largely in group sessions. Groups representing the major divisions of business will take up the questions before the meeting in their relation to the particular interests or industries within the group.

Service Charge Approved in Malden Case

A GRADUATED service charge in connection with a selling price of not over $1.25 per 1,000 cu.ft. of gas was approved last week for the Malden & Melrose Gas Light Company by the Massachusetts Department of Public Utilities. This is the first case under the service charge law of Massachusetts concerning a company of substantial size, and it is regarded as an important precedent in the establishment of such charges by both gas and electric companies. The company's former schedule in most of its territory for the first 35,000 cu.ft. was 15 cents net per 100 cu.ft., with a minimum charge of $7 per year. It proposed to introduce a service charge of 50 cents per month to all customers having a ten-light meter or one of less capacity which would gradually increase to $5.75 for a 300-light meter or one of greater capacity, and a further charge of 12 cents net per 100 cu.ft. for all gas used. In its decision the commission graduated the service charge at from 35 cents per month for a ten-light meter to $5.60 for a 300-light meter and fixed the consumption rate at 12.5 cents net per 100 cu.ft.

In its finding the commission points out that the minimum charge already existing yields in revenue only the excess over the value of the gas consumed, an amount shown in this case to be negligible and equal to but a small proportion of the expenses, which are determined by the number of customers rather than by the amount of gas sold. Distinctively customer expenses include resetting and removing meters, repair of meters and service pipes, complaint work done on customers' premises, meter reading, bookkeeping, billing and collecting and losses that occur on bad bills. To this the company added 20 and 25 per cent respectively of insurance and general expenses and a fixed charge of 13 per cent of the investment in service pipes. The board concluded that customers using little or no gas not only contributed little to the company's revenue but not enough to cover the company's out-of-pocket expense incurred solely for them. The issue was really one between the customers themselves as to the most equitable method for raising a given amount of revenue, and with the exception of Commissioner Stone the board approved the charges and rate as coupled in the foregoing summary.

California Railroad Commission Orders Emergency Rate Reductions

RATE changes described by the California Railroad Commission as similar to those made by emergency orders during the war period, except that they carry decreases instead of increases, have been enforced by this commission as a result of hearings in which the Southern California Edison Company was concerned and of other hearings affecting the San Joaquin Light & Power Corporation. In the latter case the commission declared that the general economic situation and peculiar local conditions justified rates that would yield less than a normal fair return.

The Southern California Edison Company was ordered to make the following reductions, beginning on May 1: Street-railway service, 8 per cent; street lighting, power and resale, 10 per cent; general lighting, 12 per cent. The reductions will not apply to minimum charges, the commission finding that minimum bills for power and lighting service have not been increased above reasonable pre-war charges. Although the reduction applies to the regular street-lighting schedule, existing contracts are not disturbed, but cities that can benefit by so doing receive the right to change over to the new schedules. A modification previously made in the agricultural schedule will increase the total reduction by reducing the minimum bill for agricultural service in the San Joaquin Valley district $3 per horsepower-year.

The commission adopted in this procedure a rate base of $102,560,000 as against the company's claim of $105,827,699 and estimated that on this basis the return of 8.3 per cent allowed in a former decision would give the company $8,512,480. Present rates computed on the estimated 1922 business would yield, it was found, a total net revenue of $10,122,000. The difference of $1,609,520 measures the amount of saving to consumers.

The reductions ordered for the San Joaquin Light & Power Corporation range from 5 to 7 per cent, also dating from May 1. The rates for domestic and commercial service is reduced from 9 cents to 8 cents for the first 30 kw.-hr.; industrial power, approximately 5 per cent; street lighting, 6 per cent, and the agricultural rates, on an average, 6 to 7 per cent. The demand charge for farm service is reduced $1 per horsepower-year and the minimum charge $3 per horsepower year. The annual demand charge and minimum bill are made payable in eight monthly installments. The rate in the oil fields is continued as now.

The rate base for the San Joaquin corporation was fixed by the commission at $32,068,293. Items deducted from the company's own valuation were: From the total of $1,700,000 for the Kern Canyon enlargement all but $500,000, because it was held that only a comparatively small part of the product can be used advantageously; $65,000, estimated as the value of the Fresno steam plant, which was eliminated as obsolete; $50,000 for damage suits, held to represent payments due to negligence and therefore not chargeable to consumers; $36,300 written off from the cost of the Kerckhoff-Merced transmission line, and $400,000 for a projected office building in Fresno, which, however, the company was urged to build. Full allowance was made for the Kerckhoff development, costing $5,691,952, a contention that part of the cost should be deducted because the work was done in a period of high prices being disallowed.

American Engineering Council Denounces Pending Patent Bills

PATENT legislation pending in the United States Senate was denounced as "dangerous and destructive of the American patent system" before the Senate patent committee in Washington on May 1 by a delegation from the American Engineering Council of the Federated American Engineering Societies. The Stanley bill and the Ladd bill would, declared Edwin J. Prindle, chairman of the patents committee of the council, so lessen the value of patents that the incentive to produce inventions would be greatly decreased and the American patent system gravely impaired.

The object of the bills, Mr. Prindle asserted, is to throw German-owned American patents open to American use and prevent the Germans from manufacturing in Germany and exporting here while restraining the use of their invention here through their American patents. The international convention, to which most of the leading countries are parties, would prevent a working clause in our law which applied only to aliens. Therefore the Stanley and Ladd bills apply to all American patents. Few individuals or corporations would buy patents with a working clause hanging over them. Those patents which become valuable only during the last two or three years of their life would almost always lapse before that period would be reached. Where a development requires a series of patents much expense would be incurred, and the earlier patents would often have to be worked before the invention was perfected. Where necessary to patent several alternative inventions if no basic patent could be obtained to cover all the forms, each of them would have to be worked. The possible expense would discourage manufacturers, and the rich inventor would be favored.

Accidents Cripple 159,000 Hp. of Ontario Hydro Units

A SERIOUS accident involving a loss of several million dollars occurred in the generating station of the Ontario Power Company of Niagara Falls, Ontario, shortly before 3 o'clock on the morning of April 20. Generator units Nos. 15 and 16, rated at 20,000 hp. each, were destroyed, and when a part of the generator of unit No. 15 was hurled through the roof the entire covering of the new wing fell, smashing the casings of the two turbines as well. The Johnson valves controlling the flow of water to the turbines were shut as soon as possible, but during the interim the water shot over the roof, flooded the whole bay, washed out part of the embankment to the rear and rushed into the main power house, flooding units Nos. 11, 12, 13 and 14, rated at 16,000 hp. each. One operator was in the damaged wing at the time and saved his life by swimming. His

DAMAGED WING OF ONTARIO STATION

escape from the wreck, however, was nothing short of miraculous. Fortunately the stop locks at the end of the station were out at the time, or the whole power house would have been flooded.

An official investigation is being conducted into the cause of the accident, the result of which will be published later As far as can be learned, the contributory cause of the mishap was a short circuit somewhere on the line of the Hydro-Electric Power Commission about 2:45 on the morning of April 20. The sudden dropping of the load caused the units feeding the line to speed up. At that time four units in the power house of the Canadian Niagara Falls Power Company, rated at 10,000 hp. each, were running in parallel with the units in the Ontario Power Company's station. When the operator in the Canadian Niagara station saw the four units speeding he pulled over the rheostats as far as they would go and also threw in the relays on the generators in an effort to cut down the voltage. This, however, had no effect, and when it was discovered that the units were being driven as motors by the larger generators in the Ontario Power Company's station, the feeder switches were pulled and the Canadian Niagara units cut off the line. Shortly afterward unit No. 15 in the Ontario Power Company's station flew to pieces.

The destroyed wing of the power house with its equipment was erected by the Hydro-Electric Power Commission of Ontario during the war to meet the

great demand for power at that time. This increased the total capacity of the station of the Ontario Power Company from 160,000 hp. to 200,000 hp. and necessitated the installation of a wood-stave pipe line with an internal diameter of 13½ feet and the two 20,000-hp. units. The temporary end wall of the old Ontario Power Company's station separated the main station from the new wing. These additions to the power house cost approximately $3,500,000.

The waterwheels were not specially designed for the installation, but were obtained from the Aluminum Company's plant at Baden, in North Carolina. They were built by S. Morgan Smith and delivered 14,000 hp. at Baden, but under the head obtaining at Niagara Falls developed 20,000 hp. The generators were built by the Canadian General Electric Company. A section of unit No. 15, weighing many tons, which went through the roof, dropped back through the station about 150 feet distant and cut out a piece of the base of unit No. 11. The force with which the piece descended was such as to make a cut almost as clean as if it were made by a machine tool, but the base of the machine was not cracked or otherwise damaged. Some doubt has been expressed whether units Nos. 15 and 16 will be replaced, inasmuch as the commission is under obligation to remove the temporary wooden-stave pipe line by 1923 and can use the water to better advantage in the new Queenston station. The other four units are still being dried out.

A few days prior to the accident one of the large units in the Chippawa-Queenston station, rated at 55,000 hp., was damaged. Fins of the fans attached to the generator for ventilating purposes dropped off and became wedged between the rotor and the winding, injuring about fifteen coils. This necessitated shutting down the machine and rewinding it, an operation which will require about three weeks. Meanwhile a third 55,000-hp. unit is being erected at Queenston, and it is hoped to have this third machine in operation by July.

The power houses of the Toronto Power Company and the Canadian Niagara Falls Power Company are being operated with their gates wide open so as to supply the Hydro-Electric Power Commission of Ontario with the requisite energy. Part of the loss is also being made up from the Niagara Falls Power Company's American plant. Less than fifteen minutes after the accident the Canadian Niagara Falls Power Company and the Toronto Power Company were feeding the Hydro-Electric power system, which within a week lost two 20,000-hp. units and the use of four 16,000-hp. and one 55,000-hp. unit.

Progress of Colorado River Development Bill to Be Slow

NO RAPID legislative progress is anticipated for the Johnson and Swing bills, which proposed plans for flood control on the Colorado River and for the utilization of the waters of the stream. Congress and the administration are participating in the systematic study of the Colorado River situation being made by the Colorado River Commission. Until this commission submits its recommendations it is improbable that serious attention will be given any legislation prescribing methods for solving the problems involved.

A number of hearings have been held, but it is intended to have further public discussion of the matter and still other hearings are scheduled to begin Aug. 1. Because of differences of opinion among the states concerned as to the best methods of utilizing the resources of the river, considerable time must elapse after the hearings before the commission can be expected to submit concrete recommendations.

Disinterested opinion on Capitol Hill is to the effect that a measure such as that proposed authorizing an appropriation of $70,000,000 would have little chance under present Treasury conditions.

Would Stop Export of Canadian Power

CONSIDERABLE interest is manifested in the news report that Dr. H. Deslauriers of Montreal has announced that he will bring before the Canadian House of Commons a resolution which would have the effect of prohibiting the export of electric power from Canada to the United States. A number of American interests now take large blocks of Canadian power. Prior to the accident suffered by the Hydro-Electric Power Commission of Ontario at the plant of the Ontario Power Company (reported on another page) the Niagara, Lockport & Ontario Power Company received under contract a large block of power from this plant. The Aluminum Company of America is served at Massena, N. Y., with energy over a 48-mile 110,000-volt line from a plant of the Montreal Light, Heat & Power Company. Besides these cases, a large part of the energy generated by the Canadian Niagara Power Company is distributed by the American company.

No Danger of General Coal Shortage for Six Weeks

IN AN analysis of the coal situation issued early this week the coal bureau of the United States Chamber of Commerce calls attention to the unusual condition found in the general lack of demand for coal that exists throughout the country. At the present rate of production and consumption there is no danger of any general shortage, says the bureau, for at least six weeks. Summing up the situation as of April 22, the bureau says:

"On April 1 the stock of coal in the hands of railroads, industrial consumers, public utilities and retailers was approximately 63,000,000 net tons. Adding to this 4,250,000 tons estimated at the upper lake docks and the unbilled coal on hand April 1, there was a total of 68,650,000 net tons above ground April 1. Stocks cannot drop below 20,000,000 tons without danger of a coal panic. The quantity of coal which apparently can be drawn from stocks before a serious situation develops is 48,650,000 tons. To this supply there will be continuously added the output from the non-union fields, which up to date has averaged about 3,500,000 tons per week. At the present time the average weekly consumption is estimated to be 8,100,000 tons. Therefore supply from the non-union fields is falling short of meeting the consumption by 4,600,000 tons per week. To cover this deficit we have the 48,650,000 tons in storage. If the consumer continues to draw from this storage at the rate of 4,600,000 tons per week and unless there is an increase in production from the non-union fields, a shortage will be felt in approximately seven weeks from April 22."

Resolution Prohibiting Issuance of Tax-Exempt Securities Reported

THE resolution introduced into the House by Representative Green of Iowa proposing a constitutional amendment prohibiting the issuance of tax-exempt securities by federal, state or local governments was formally reported on Wednesday by the ways and means committee. Estimates obtained by the committee, the report said, showed that tax-free securities now amount to between $10,000,000,000 and $18,000,000,000 and that the right to issue was "a constant temptation to issue in larger amounts than is necessary."

The report said that the present system enables much property to escape taxation, unfairly discriminates between taxpayers, impedes private financing, discourages investment in new enterprises and creates social unrest.

Interconnection Proves Value in Texas Floods

ALTHOUGH Fort Worth, Tex., was visited last week with the highest flood condition that the Trinity River ever recorded, the city was never without electric service. The river broke through its embankments, flooding the city and flooding the boiler room of the Fort Worth Power & Light Company's plant. The plant was shut down for twelve hours and was then again started. In the meantime the city was served from the lines of the Dallas Power & Light Company and the Texas Power & Light Company, which are interconnected with the Fort Worth system.

Henry Ford Modifies Muscle Shoals Offer and Makes Concessions

INVESTIGATION of the private offers to purchase or lease the government's nitrate and power projects at Muscle Shoals, Ala., and to construct the necessary plants continued in Washington before Congressional committees during the week. The most notable feature of these investigations was the appearance before the Senate committee on agriculture and the House military affairs committee of W. B. Mayo, chief engineer for Henry Ford, to make further concessions and modifications in Mr. Ford's offer. By these Mr. Ford's insistence on obtaining possession of the Gorgas plant on the Warrior River, the government portion of which the Alabama Power Company has a contract to purchase, was tuned down. Mr. Ford surrendered the idea that the government should furnish him with a deed and clear title to this property and offered to amend the phraseology of his proposal as follows: "The company agrees to accept and the United States to assign and transfer to the company all rights, title, interest, power and benefit belonging to or that may accrue to the United States or its legal agents as a party to the contract." Another suggested change in wording is this: "And the company will assume all obligations and liabilities lawfully imposed upon the United States by said contract." Among other concessions offered a plan is included to pay 4 per cent interest to the United States on the cost of acquiring lands and flowage rights at Dam No. 3.

The House committee continued its "informal conversations," with no sign of an agreement resulting because of the modifications made in Mr. Ford's offer. The Senate committee perfected a plan to speed up its hearings and at the end of the week had before it J. O. Hammitt, vice-president of the Air Nitrates Corporation, which has a contract to purchase Nitrate Plant No. 2 from the government, notwithstanding Mr. Ford's insistence that he must have this plant. Mr. Mayo told the Senate committee in this connection that Mr. Ford's research engineers are working on a "new secret process" for the manufacture of fertilizer which it is the intention to manufacture at the same time with electric furnace steels and aluminum.

Illinois Central to Electrify Terminal at Cost of $80,000,000

STOCKHOLDERS of the Illinois Central Railroad have voted to issue $50,000,000 in preferred stock to finance the electrification of the road's Chicago terminal. Approval of the issue by the Interstate Commerce Commission will, it is officially announced, be followed by the beginning of work within ninety days. Under its contract with the city the Illinois Central will spend more than $80,000,000 in this work, receiving in return riparian rights and the title to made land.

The city ordinance passed after the agreement had been ratified requires that suburban service be electrified by 1926. Time is allowed for the work of depressing tracks. Freight service north of Roosevelt Road will be electrified by 1929 and south of it by 1934. Through passenger service must be entirely under electric operation by 1939.

A. S. Baldwin, vice-president in charge of electrification, and Hugh Pattison, chief of the engineering staff, are now in Europe studying systems in use on the Continent. They will return this month.

Radio Conference Recommendations for Federal Control

FINAL recommendations of the radio-telephone conference called by Secretary Hoover were made public last week. This conference, under the chairmanship of Dr. S. W. Stratton, director of the Bureau of Standards, and composed of a number of radio experts, received since its first session about two months ago a number of suggestions on its preliminary report and, after considering these on April 17, 18 and 19, made its final recommendations, which are to be the basis for legislation giving the Secretary of Commerce the authority to make and enforce regulations. This control, it was recommended, should cover the establishment of all transmitting stations except amateur, experimental and government stations, and also the operation of non-government transmitting stations.

It was the sense of the conference that radio communication is a public utility and as such should be under federal regulation. One interesting resolution proposed that "the types of radio apparatus most effective in reducing interference should be made freely available to the public without restriction."

Wave lengths, it was recommended, should be assigned in bands according to the class of service, details of which are given in the report. It was recommended that the Secretary of Commerce assign a specific wave

length, within its band, to each broadcasting station, except government and amateur stations, and that the wave band, 150 m. to 275 m., assigned to amateurs be subdivided according to the method of transmission.

The conference disapproved of the elimination of essential services in order to take care of indirect advertising. "Point to point" communication over land was considered an uneconomical use of available wave bands, and so it was recommended that for the present at least such communication where possible be carried on by other means.

Use of unlimited power by broadcasting stations was disapproved and the following ranges were recommended: Government stations, 600 miles; public stations, 250 miles; private and toll stations, 50 miles.

Detailed recommendations for considerations to be followed in granting licenses were made, among which is one recommending that direct advertising by broadcasting be absolutely prohibited and that indirect advertising be limited to a statement of the station's call letters and the name of the concern responsible for the material broadcasted.

Amateurs, it was recommended, shall have their status determined by law, be under the jurisdiction of the Department of Commerce and be self-policed under a recommended plan.

The Secretary of Commerce, it was recommended, should prohibit transmitting apparatus and methods which result in unnecessary interference when more satisfactory apparatus is available at reasonable prices. For the reduction of interference the Bureau of Standards, it was recommended, should make technical studies with special attention to the following: Reduction in rate of building up oscillations in radiating systems, reduction of harmonics in continuous wave transmitters and of oscillation irregularities, comparison of the variable-amplitude method with the variable-frequency method of continuous-wave telegraphy, preferable methods of telephone modulation to avoid changes in frequency, proper arrangement of regenerative receivers to avoid radiation, use of highly selective receiving apparatus, use of receiving-coil aërials instead of antennas, other electrical processes such as X-ray and precipitation wave meters.

A provision was added calling for the appointment by the President of an advisory committee of twelve equally divided between the government and others.

Utility Purchasing Agents' Organization Proposed

A MOVEMENT looking to the organization of a division for public utility purchasing agents in the National Association of Purchasing Agents has been started. Harry H. Lloyd, purchasing agent for the Indianapolis Street Railway Company and the Terre Haute, Indianapolis & Eastern Traction Company and the chairman of the public utilities and public relations committee of the Indiana association, was at the Indianapolis convention of the National Association of Purchasing Agents appointed chairman of a tentative national committee for the formation of such a division. If sufficient interest is manifested by utility purchasing agents at the Rochester convention on May 15-20, the organization of a national committee and the division can be undertaken at that time.

Census of Electrical Engineers and Electricians

WHEN the 1920 census was taken there were 27,077 electrical engineers engaged in the practice of their profession throughout the country. This compares with 15,278, the number of electrical engineers shown in the 1910 census. It may be stated, however, that the 1910 figures were not gathered with the same detailed care as those of 1920, a portion of the former figures being made up of estimates. In 1920 there were 212,964 electricians, as compared with 120,241 in 1910.

Michigan and Florida Projects Seek Permits

THE White Rapids Paper Company of Oshkosh, Wis., has applied to the Federal Power Commission for a preliminary permit to cover a project on the Menominee River, 15 miles north of Kells, Mich. It is estimated that 5,700 hp. of primary power is available. It is the intention to install equipment sufficient to generate 10,000 hp. The power is to be used in the operation of a paper mill and public utilities.

Benjamin H. Hardaway of Columbus, Ga., has applied for a preliminary permit to cover a power project in the Chipola River, 20 miles below Marianna, Fla. He estimates the primary power at 3,000 hp. He expects to install 7,500 hp. The power is intended for public utility use.

N. E. C. Radio Regulations Modified

THE National Board of Fire Underwriters has published tentative regulations covering radio receiving installations that disclose considerable modification as compared with the previous requirements. The specifications were drawn up by a special committee of the National Fire Protection Association and on it were underwriters' representatives and engineers acting for the American Radio Relay League, American Telephone & Telegraph Company, Radio Corporation of America and the Independent Telephone Association.

The new rules are being published as proposed amendments to be included in future editions of the National Electrical Code. It is stated that the requirements contained in the current edition of the code were based largely on the hazards incident to the equipment of wireless-telegraph transmitting stations where antennas of considerable height and length were used and where the hazard of high-potential equipment had to be considered.

Four Hundredth Meeting of the New York Electrical Society

THE New York Electrical Society, the oldest electrical society in the United States, celebrated on April 26 its four hundredth meeting by a visit to the new Hell Gate plant of The United Electric Light & Power Company. A luncheon was given to more than 300 guests by the company, and an address on "Thirty Years of Alternating-Current Service in New York City" was delivered by Frank W. Smith, vice-president of the company.

Additions Being Made to Indianapolis Electric System

EXTENSION of the service of the Indianapolis Light & Heat Company that will provide for the growth of the city for the next twenty-five years has been made through an improvement program which has been going forward for the last eight months and which is to continue during the summer season, according to C. C. Perry, president of the company. The equipment to be added to the system includes a large 30,000-hp. turbine unit, a third unit in the storage-battery standby system, to which will be added a fourth on completion of the building now under construction, and new motor-generating sets.

Ordered to Reduce Funded Debt to Improve Financial Condition

THE Indiana Public Service Commission has authorized a financial reorganization of the Northern Indiana Gas & Electric Company, operating a number of utilities in Indiana, in order to improve the financial condition of the company and enable it to sell securities for making plant improvements. The reorganization will decrease the bond and note obligations of the company by $8,909,710, on which the annual interest charges are $526,113. The interest on common and preferred stock will offset this saving if dividends are paid, members of the commission said. New financial obligations of the company will be as follows: Common stock, $5,000,000; preferred stock, $9,000,000; bonds and notes, $14,458,000. Improvements on plants of the company are to be financed by a bond issue for $1,030,000.

April Financing on 6½ per Cent Basis Average

STOCKS and bonds amounting to $43,151,080 were offered to investors by the electric light and power public utilities during the month of April. This figure represents a decrease of more than $12,000,000 under the total reached in March and an increase of more than $8,000,000 over April of last year. The rate of return yielded the investor continued to decline —6.50 as compared with 6.62 for the month of March and 6.90 for February. Long-term securities continue to predominate. Only one 8 per cent issue was floated last month, and that at par. A few 7 per cent issues came out, but for the most part the new offerings bore 6 per cent coupons. Again some 5 per cent issues appeared. Special attention, however, is called to the Cohoes Power issue, a 6 per cent bond at 1½-point premium.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered at
United Light & Railways Co. (Mich.)	$7,000,000	Thirty-year	First lien and consolidated mortgage gold bonds, series A	Refunding	6	6.45	93¼
Metropolitan Edison Co. (Pa.)	4,555,000	Thirty-year	First and refunding mortgage gold bonds, series B	Refunding	6	6.10	98½
Pennsylvania-Ohio Electric Co. (Ohio)	1,950,000	Sixteen-year	First mortgage and collateral-trust sinking-fund gold bonds, series A	To retire maturing bonds and to be applied to floating debt incurred for additions	6½	6.80	97
Eastern Wisconsin Electric Co. (Wis.)	450,000	Twenty-five-year	First and refunding mortgage gold bonds		5	6.20	85
Luzerne County Gas & Electric Co. (Pa.)	1,000,000	Twenty-year	Sinking-fund gold bonds	To provide funds for general corporate purposes	7	7.50	95
San Joaquin Light & Power Corp. (Cal.)	3,500,000	Thirty-year	Unifying and refunding mortgage gold bonds, series B	To provide for necessary extensions to plant	6	6.05	99½
Cohoes Power & Light Corp.	675,000	Seven-year	First mortgage gold bonds		6	5.75	101½
Potomac Public Service Co. (Md.)	2,155,000	Twenty-two-year	First and refunding sinking-fund gold bonds		7	7	100
Philadelphia Suburban Gas & Electric Co.	2,000,000	Forty-seven-year	Gold bonds	To retire maturing bonds and to provide funds for other corporate purposes	6	6.50	93
Ozark Power & Water Co. (Mo.)	2,000,000	Thirty-year	First mortgage bonds		5	6.90	76
Georgia Railway & Power Co.	3,500,000	Twenty-five-year	General mortgage gold bonds		6	6.40	95
Penn Public Service Corp.	4,500,000	Twenty-five-year	First and refunding mortgage gold bonds, series C	To acquire in fee ownership other property and for extensions and additions	6	6.05	99½
Puget Sound Power & Light Co.	1,100,000	.....	Cumulative prior preference stock	To provide funds for retirement of floating debt incurred for construction purposes	7	6.75	104
San Angelo Water, Light & Power Co. (Tex.)	250,000	Ten-year	Guaranteed gold notes	To make additions, extensions and improvements	8	8	100
Lowell Electric Light Corp.	416,080	.....	Capital stock		..	....	....
Oklahoma General Power Co.	2,750,000	Thirty-year	First mortgage gold bonds, series A		6	6.60	92
Escanaba Power & Traction Co. (Mich.)	300,000	Twenty-year	General and refunding gold bonds, series B	For refunding and for working capital	6	6.50	94½
Los Angeles Gas & Electric Corp.	500,000	.....	Cumulative preferred stock		6	6.86	87½
Nova Scotia Tramways & Power Co.	1,250,000	Thirty-year	General mortgage gold bonds, series A	To fund maturing note issue	7	7.20 7.30	97½* 96½†
Manila Electric Co. (Philippine Is.)	2,500,000	Twenty-year	First refunding mortgage gold bonds	To provide funds for refunding notes falling due, for additions and other corporate purposes	7	7.10	98½
Illinois Power Co.	800,000	Eleven-and-one-half year	First mortgage gold bonds, series A		5	6.60	87½
Total	$43,151,080						

* Canadian funds. † New York funds.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Latest from Russia.—It is announced from Moscow that a new department of the soviet government will be created to regulate the electrical power and fuel industry. The new bureau will, the dispatch continues, correspond in many respects to the public utility commissions maintained in the United States.

Oklahoma Utility Assessments Increased 30 per Cent. — Tentative tax assessments for 1922 on Oklahoma public utility companies average about 30 per cent higher than those of last year, and the utilities are expected to protest. In 1921 the public service corporations of Oklahoma paid approximately one-sixth of the state taxes, many utilities being assessed, it is reported, on a higher basis than other industries.

Electric Trucks in India.—In faraway Calcutta the electric truck is holding its own in competition with its gasoline-driven rival. Heretofore two "electrics" and ten "petrol" vehicles have been employed to remove the city's refuse, all of them having a capacity of 3½ tons. The city authorities are now arranging for eight more of the electric trucks, of which the running cost, excluding interest and depreciation, is only half that of the gasoline truck. In Bombay electric vehicles are employed for the same purpose, and very little battery trouble is reported.

English Student Wins Scientific Research Prize for Women.—The annual prize of $1,000 awarded by the Association to Aid Scientific Research by Women was won this year by an English student. Thirteen papers were reviewed by the association's committee meeting at Bryn Mawr College, Pennsylvania. The winning paper, presented by Dr. Anna Catherine Davies of Royal Holloway College, Englefield Greens, England, was on the subject "Investigation of Critical Electronic Energy Associated with the Excitation of the Spectra Helium." Of the other papers submitted five were from England, five from the United States, one from Australia and one from Russia.

Lord Haldane Champions Superstations.—In the British House of Lords recently Lord Haldane, better known as a literary man than in other relations, showed himself possessed of the engineering sense by his advocacy of the electricity supply bill. He pointed out that small generating stations had been shown to be wasteful of fuel and suggested that there was a strong case for the abolition of the old system under which six hundred "generating authorities" were working in conditions which lagged behind the modern standpoint. Under the provisions of the bill he claimed that the generation of electricity would take place on a large scale near the collieries and that local authorities and the groups which had been organized for the purpose would be in a position to supply electrical energy for power and lighting at a low rate. Lord Haldane reminded his hearers that in the United States and the Continent energy is furnished at much lower rates than in Great Britain, a result he held to be largely due to its generation in superstations.

Electrical Development in Arkansas.—The Arkansas Light & Power Company has just concluded a contract to furnish power for the operation of the mills and mines of the Aluminum Company of America at Bauxite, Saline County, Ark. The company is constructing a 54-mile, 66,000-volt transmission line from Picron to Malvern, Ark. This transmission line will tie in the extensive transmission system in the Arkansas rice fields and the electrical power plants at Pine Bluff, Picron, Little Rock and Malvern. The new line will supply Benton, Bauxite and Mabelville. The proposed water-power developments on the Caddo River will be connected with this transmission line.

Revenue of California Companies.—The Great Western Power Company of California, operating in San Francisco, Oakland, Sacramento and elsewhere, has reported to the Railroad Commission that its operating revenue for the year 1921 was $6,404,621 and its operating expense $2,671,247, giving a net operating revenue of $3,733,373. The net corporate income was $1,676,216. The company declared dividends of $610,697 during the year, leaving an accumulated surplus of $5,259,688. The Southern Sierras Power Company, operating in Riverside, San Bernardino, Corona and vicinity, has reported that its operating revenue for 1921 was $2,029,129 and its operating expenses $862,980, giving a net operating revenue of $1,166,148. The net corporate loss for the year was $76,147, leaving an accumulated surplus of $98,860.

Iron-Stand Specifications Adopted by New York Underwriters.—Specifications for a stand for pressing irons heated by electricity, gas or otherwise, evolved by the New York Board of Fire Underwriters in conjunction with the Continental Insurance Company, have been adopted as standard requirements in the territory of the New York Fire Insurance Exchange. The requirements, which are met by a number of stands on the market at the present time, provide for the use of three parallel sheets of No. 20 gage or heavier metal, securely riveted together so as to leave an air space of ⅝ in. between the upper plate and the one below it and the same space between the latter and the one below. The upper sheet is to be slightly larger than the pressing iron and to have front and side turned up about ⅝ in. to prevent the iron from slipping. At least five rivets are to be used in the construction of a stand of ordinary size.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

National Fire Protection Association.—The annual meeting of this association will take place at Atlantic City on May 15-19, simultaneously with the sessions of the National Electric Light Association.

Electrical League of New Orleans.—Officers for the ensuing year have been elected by the Electrical League of New Orleans as follows: President, R. A. Riley; vice-president, M. J. Elgutter; secretary and treasurer, C. Discher. The league reports a large and enthusiastic membership.

New York Electrical Companies to Hold Convention.—The annual convention of the Metropolitan New York Section of the National Electric Light Association is to be held in New York on Friday, May 26. Business sessions covering the commercial, technical, accounting and administrative problems of the local electric light and power companies will be held in the morning and afternoon at the Engineering Societies Building. In the evening there will be an entertainment and dance at the Waldorf-Astoria.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Philadelphia, May 6; Chicago, May 8, Cleveland, May 8.

A. I. E. E. Section Meeting—Detroit-Ann Arbor, May 12.

A. S. M. E. Spring Meeting—Atlanta, May 8-11. (For program see issue of April 15, page 750.)

Florida Engineering Society—Daytona, Fla., May 15-16.

N. E. L. A. Annual Convention—Atlantic City, May 15-19. (For program see issue of April 22, page 797.)

National Fire Protection Association—Atlantic City, N. J., May 15-19.

National Electrical Credit Association—Detroit, May 18-19.

Electrical Supply Jobbers' Association—Hot Springs, Va., May 24-26.

N. E. L. A. Geographic Divisions—Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7.

Electric Power Club—Hot Springs, Va., June 5-7.

Canadian Electrical Association—Ottawa, Ont., June 15-17.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

National Council of Lighting Fixture Manufacturers—Cleveland, June 28-29.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14.

International Association of Municipal Electricians—New Bedford, Mass., Aug. 22-25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Municipalities to Have Longer Notice of Rate Increase Applications. — A recent rule of the Oklahoma Corporation Commission requires that copies of the applications for rate increases and copies of the exhibits shall be filed with the city attorney for the municipality affected thirty days before the date set for hearing of the application, instead of ten days as heretofore.

Rules Governing Combined Electric Plant and Lumber Mill. — The Montana Public Service Commission, investigating the P. L. Howe Lumber Mills at Eureka, Mont., decreed that such a company furnishing electricity as a public utility should charge to the lumber department a sufficient electric rate to care for return on the value of the plant and other property in addition to the actual cost of energy production. The cost of slab wood used as fuel in generating electricity for commercial use should be borne by the electric department when it shall appear that a cheaper fuel in the form of shavings and edgings produced by the mill would be sufficient to supply the boilers with fuel if it were not for the commercial electric production.

Return on Overbuilt Plant.—In determining rates for the Milford Electric Company, whose market is restricted to a population of approximately a thousand persons, the Michigan Public Utilities Commission declared that the customers of any utility are entitled to service at what such service is reasonably worth and not at what the service actually costs and therefore fixed the rate base at less than the estimated original cost of the plant or the cost of reproduction less depreciation. "Engineering reports," said the commission, "are helpful guides in arriving at values where a plant has been judiciously conceived and honestly constructed, but render little or no help in arriving at the value of a plant which never should have been built or where a different type should have been installed."

Production Cost of Electricity.—Advertising to "the false assumption that it is possible for the producer of electrical energy to determine the busbar cost of the various quantities of kilowatt-hours produced by it," the Indiana Public Service Commission in an electric rate case *in re* the Fort Wayne & Northwest Railroad Company went on to say: "The practical method of finding out what the bare production cost of electrical energy is per kilowatt-hour is to divide the cost of fuel, labor, etc., by the number of kilowatt-hours generated. The large power consumer has the advantage of getting part of its energy under the lower blocks of a graduated schedule, which is the method used in compensating it for the fact that its consumption is the element which enables the producing company to produce a large amount of energy at a decreased cost per kilowatt-hour. . . . The graduated schedule is the method used to give the large consumer the advantage of a lower rate per kilowatt-hour, which was made possible by the increased production due to its large consumption."

Utah Commission Forbids Discrimination.—The Morgan Electric Light & Power Company, which buys its power supply from the Utah Power & Light Company, has received permission from the Public Utilities Commission of Utah to raise its rates to the level of rates charged for similar service by the latter company. The Morgan company showed that it had been operating at a loss for several years past. A fifty-year contract held with the Morgan Canning Company was an issue in this hearing. It was signed in 1914 and provided that the canning company should have its power at cost. Of this contract the commission said: "The rate named in the contract with the Morgan Canning Company should be brought to the general level of rates for petitioner for like service of the Utah Power & Light Company. To do otherwise would be clearly discriminatory and illegal. We find nothing in this contract which would justly put it in a class exempting it from modification of the rate. It comes clearly within the scope of decisions heretofore made by this commission covering like cases."

Eight per Cent Not a Uniform Standard of Proper Utility Returns.—Holding that to fix a uniform rate of return for all utilities would be a discrimination against the utility which has been efficiently managed and operated and would reward beyond its deserts the poorly managed utility or one less fortunately situated, the New Jersey Board of Public Utility Commissioners, in fixing rates for the Somerville Water Company, said: "If a company has a long record of efficient operation during which it has earned a yield of 8 per cent or more upon the property devoted to the public service, the board is inclined to allow such company a higher rate than it will allow to a company whose history shows that it has rarely been able to earn an 8 per cent return under rates fixed by itself and admittedly satisfactory to it. So, too, it must not be supposed that because the board has at some time or other seen fit to establish an 8 per cent rate of return for a utility which theretofore had been taking from the public a much higher rate of return such decision of the board is to be taken as a precedent by another utility which is not earning and rarely has earned an 8 per cent return, upon which to make a claim that it shall be lifted to this level of net earnings."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Commission May Order Refund Because of Inefficient Service.—The United States Supreme Court has held, in Oklahoma Natural Gas Company vs. State of Oklahoma, that an order by the commission requiring a gas company to refund certain percentages of its charges to its customers because of insufficient pressure in its pipes did not deprive the company of its property without due process of law. This decision sustains that of the Supreme Court of Oklahoma. (42 S. C. R. 11.)

Employee Sustaining Compensable Injury Entitled to Sue Wrongdoer.—In Texas Compensation Insurance Company vs. Orange Ice, Light & Water Company, an action to recover damages paid under the state workmen's compensation law to an employee of a telephone company, it was held by the United States Circuit Court of Appeals in Texas that the employee had good cause of action not only against the telephone company for failure to furnish him with a safe place to work but also against the lighting company and a paper-mill company for causing the place to be unsafe, it appearing that the accident was caused by the man's coming into contact with a guy wire owned by the paper-mill company and charged with electricity because of a defectively insulated wire of the lighting company. (278 Fed. 8.)

Negligence Presumed in Case Where Telephone Exchange Caught Fire from Power-Transmission Wires. — Sustaining a judgment for the plaintiffs in Davidson vs. Alabama Power Company, where damages were sought because of the burning of a telephone exchange owing, as alleged, to the escape of electricity from the defendant's power-transmission wires, which were in contact with its telephone line to complainants' switchboard, the Supreme Court of Alabama held that the trial court did not err in submitting to the jury the question of whether defendant exercised due care in providing safety appliances, that a conversation between employees of defendant heard over the telephone was admissible as evidence, and that the lower court properly refused to charge that if defendant's telephone wire was no nearer its transmission line than the best regulated concerns of defendant's character placed them, and the transmission line was being operated as the best transmission lines are operated, defendant would not be liable. (90 So. 915.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Philip C. Jones has been appointed chief electrical engineer of the Goodyear Tire & Rubber Company and will have complete charge of the extensive

P. C. JONES

electrical installation of that company. The plant of this company at Akron, Ohio, is probably one of the most highly electrified in the country, having an installed motor rating of 60,000 hp. and a monthly consumption of about 16,000,000 kw.-hr. in normal times. All the energy is generated in the company's private plant. Mr. Jones is a graduate of the Massachusetts Institute of Technology and has had an extensive experience, including connections with Swift & Company in Chicago, D. C. & W. B. Jackson, consulting engineers, and with the São Paulo Tramway, Light & Power Company in Brazil. He has been connected with the Goodyear Tire & Rubber Company for several years and until recently had charge of the electric installations in its Los Angeles plants.

W. J. Brown has been promoted to the position of chief engineer of the Oklahoma Gas & Electric Company. Mr. Brown has been with this company for the past fifteen years.

R. F. Reading, electrical engineer with the Houston (Tex.) Electric Company, has resigned and is now connected with the Southwestern Gas & Electric Company at Texarkana, Ark.

Harry Reid, president of the Interstate Public Service Company and vice-president of the newly formed Indiana Hydro-Electric Power Company, has been elected president of the Great Lakes Division of the National Electric Light Association.

John C. Boyle has recently been appointed manager of the Klamath division of the California-Oregon Power Company, with headquarters at Klamath Falls, Ore.

Thomas E. Crossan has been appointed chief engineer of the Ponce (Porto Rico) Electric Company, a Stone & Webster property. Mr. Crossan was formerly assistant chief engineer of the Houghton (Mich.) power station.

Earl E. Norman has been appointed superintendent of the Department of Public Utilities of the city of Kalamazoo, Mich. Mr. Norman was graduated from the University of Michigan in 1917 and for three and a half years was employed by the General Electric Company at Schenectady and also in construction work for that company at Atlanta, Ga. He resigned from the General Electric Company the first of this year to take up his present work.

Peter H. Bullock, chief engineer of the Massachusetts Reformatory, retires May 1 after a service of forty-two years. Mr. Bullock in 1884 installed the first electrical equipment in the reformatory, after a two years' argument with the directors in an effort to persuade them that, while electricity might be used for purposes of execution, yet it could also be installed in the reformatory without danger of harm to the inmates. Mr. Bullock has installed all types of apparatus as they have been perfected, from the early Edison bipolar machine to the turbine-driven generator of the present day.

E. R. Shepard, who is well known in connection with the electrolysis work of the Bureau of Standards at Washington, has retired from that institution in order to pursue the same line of endeavor under his own name. Mr. Shepard was born in Salt Lake City in 1880 and received his early education in Oregon. In 1904 he was graduated from the electrical engineering department of the University of California. and in 1906 received the degree of M. A. from Harvard University after two years of post-graduate work in physics and engineering. Upon the completion of his academic training Mr. Shepard entered the employ of Stone & Webster and was associated with the Columbus (Ga.) property of that firm for nearly two years. From 1909 to 1914 he was assistant professor of electrical engineering at the Oregon Agricultural College, resigning to take up his present work at the Bureau of Standards. Mr. Shepard's publications, his numerous electrolysis surveys and field studies and his activity in connection with the publications and research work of the American Committee on Electrolysis, of which he is a member, have given him a wide acquaintance and an enviable reputation in his chosen field. He will conduct his business for the present from 4111 Fessenden Street, Washington, D. C.

Rufus G. Gentry has been appointed commercial manager of the Denver Gas & Electric Light Company as a result of the recent promotions made by that company. Mr. Gentry goes to this new position after almost twenty-six years of experience in the business of salesmanship. He was born in Stephens,

R. G. GENTRY

Ark., June 11, 1875. After completing a business and commercial course at Little Rock, he entered the employ of a commercial company as bookkeeper, but in 1900 entered the electric light and power field as solicitor and meter reader of the Denver Gas & Electric Light Company. In February, 1902, he was made assistant to the commercial manager as contract agent, and he continued in this position in its different phases until April 1, 1922, when he was promoted to the post of commercial manager. Mr. Gentry has served on the board of directors of the Denver Manufacturers' Association, and he also served as director and treasurer of the Colorado Manufacturers' Association, which office he holds at the present time.

Harry W. Osgood has joined the engineering department of McClellan & Junkersfeld, Inc., New York, as an electrical engineer. Mr. Osgood was with Stone & Webster, Inc., fourteen years and has had a varied experience in design and construction of power plants and distribution systems and other engineering work for public utility and industrial companies. In 1917 he was assigned by Stone & Webster to the American International Shipbuilding Corporation as electrical engineer for the design and construction of the Hog Island Shipyard at Philadelphia. In 1919 he became electrical engineer for plant construction for the Bethlehem (Pa.) Shipbuilding Corporation.

J. M. Pratt has been appointed assistant sales manager of the Rumsey Electric Company, Philadelphia. Mr. Pratt has been connected with the company for a number of years.

S. F. Bodler has been appointed Western representative for the radio lightning arresters manufactured by the Electric Service Supply Company, Philadelphia. He will make his headquarters in San Francisco.

J. G. Harvey, formerly in charge of the field force of the Westinghouse Lamp Company, Chicago district office, is now with the Luxam Electric Company, Fort Wayne, Ind., in a directing capacity.

John M. Bailey, who has been secretary of the Pittsburgh Testing Laboratory for the past thirty years, has resigned to become vice-president and secretary of the Standard Inspection Company, with offices in the Bessemer Building, Pittsburgh.

Arthur H. Crowell, who for seven years has been one of the road salesmen for the Washington Electric Supply Company, Spokane, has resigned to become connected with the Arthur Fowler Company. He will devote his time to that company's line of electric water heaters and accessories.

Ralph Barstow has resigned his position as general sales manager of the Greenfield Tap & Die Corporation and will engage in business for himself as merchandising counselor with Marquis Regan, Inc., 21 East Fortieth Street, New York.

Henry P. Rankin, who for the last few years has been Pittsburgh district manager for the Johns-Manville Company, has been made manager for both the Cleveland and Pittsburgh territories. His headquarters will be in Cleveland. Mr. Rankin was connected for a number of years with the Pittsburgh Crucible Steel Company.

Edward Blake, Jr., has been made vice-president of the Greenfield Tap & Die Company, Greenfield, Mass., and in that position will have charge of sales. Mr. Blake has been active at various times in the management of the Lincoln Twist Drill Company and the Wells Brothers' Company, subsidiaries of the Greenfield company.

Richard L. Foster has succeeded Thomas H. Taylor, retired, as assistant general sales manager of the American Steel & Wire Company in the Eastern district. Mr. Foster has been in the New York office of the company as manager of the merchant sales department for the past year. He has been connected with the wire industry since 1901. At that time he became connected with the J. C. Pearson Company, and in 1913, when the American Steel & Wire Company took over the business, became vice-president, and in 1915 president, of the successor, J. C. Pearson, Inc. In 1921 this business also was taken over by the American Steel & Wire Company, and Mr. Foster entered the New York office.

Mark S. James has been made second vice-president of the Treadwell Engineering Company, Easton, Pa.

W. E. Martin, recently placed in charge of marine work for the Westinghouse Electric & Manufacturing Company on the Pacific Coast, will make his headquarters in San Francisco. Before going West he was well known in Eastern marine circles. Mr. Martin has been interested in electric propulsion and auxiliaries for ships for many years. Since he joined the Westinghouse company in 1915 he has been an active proponent of the Diesel electric propulsion idea for certain types of vessels. Although born in Brooklyn, N. Y., Mr. Martin has spent many years in the West, having moved there in his early youth, and it was there that he received his degree in electrical engineering from the University of Colorado. Mr. Martin is an associate member of the A. I. E. E. and the Society of Terminal Engineers.

W. E. MARTIN

Obituary

Joseph L. McKernan, plant engineer for the Le Roy (N. Y.) Hydraulic Electric Gas Company, died recently as the result of a distressing accident caused by the breaking of a steam pipe line, Mr. McKernan being scalded by the escaping steam.

Alfred Clarke, widely known as an inventor and mechanical engineer, died at his home in Walpole, N. H., on April 27. He was born in Leicester, England, on June 4, 1849. He was educated in the public schools of Leicester and at the Department of Science and Art at Kensington, London. He came to America in 1874 and was chief engineer for a number of manufacturing companies. Mr. Clarke, in association with Arthur E. Childs, founded the Light, Heat & Power Corporation of Boston, which led to the formation of the Massachusettts Light Companies, owning some twenty-seven gas, electric light and power companies in Massachusetts of which Mr. Clarke was president when he retired seven years ago.

Major Thomas B. Lee, one of the most prominent of the veterans of the War between the States and a leader in his field of civil engineering in the South, died at his home in Charlotte, N. C., on March 13, at the age of eighty-seven years. By profession a civil engineer, Major Lee was in active practice up to the time of his death, and as a construction engineer had been connected with some of the largest and most important undertakings in the South. He was born in Camden, S. C., in 1835, and was educated at the Citadel, in Charleston, S. C. The first portion of his life was given over to the construction of some of the largest railroads in the South. In 1905 he became associated with his nephew, W. S. Lee, vice-president and chief engineer of the Southern Power Company, and with this company he was active for several years. In 1910 he again entered the railroad field as chief engineer of the Piedmont & Northern Railroad Company. After completing his work for this company he resumed private practice, which he continued without interruption until his death.

Sir John W. Benn, Bart., chairman of the board of Benn Brothers, Ltd., the largest publishers of technical and trade papers in Great Britain, died in London on April 10, in his seventy-second year. He was seized with hemorrhage of the brain on March 31 and succumbed ten days later to pneumonia. Sir John's first venture into the publishing field took place in 1880, with the launching of *The Cabinet Maker*. The venture succeeded, and the business expanded until at his death the firm was publishing thirteen business journals, including the *Electrician*, the *Gas World* and the *Chemical Age*. Side by side with the growth of the business of publishing trade and technical journals there also developed a very large business in high-class technical and art books. Though the close touch which he maintained with electrical matters through the medium of the *Electrician* had only been of a few years' duration, his connection with the industry was of a much more ancient character. He was an ardent supporter of municipally owned electric tramcars in London, and it is largely owing to his energy and enterprise that a wide network of communications is now spread over much of that metropolis. In non-electrical matters, such as housing, welfare measures and sanitation, Sir John's influence was wholly in the direction of better municipal government. His long experience in the London County Council, of which at the time of his death he was the "father," was of the greatest use both to his colleagues and to the officials, and it is not too much to say that the London of today is in part his creation. He was the leader of the Progressive party in London, chairman of the County Council, deputy lieutenant of the County of London and a member of Parliament.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Bookings Better for Both Large and Fractional-Horsepower Motors

THE demand for motors of both the large and the fractional-horsepower type has improved somewhat in the last month, it is learned. That orders for fractional-horsepower motors are better is not surprising in view of the fact that the market for motor-driven household appliances is again active. As reported in this section last week, the washing-machine industry reported March as its best month since October, 1920. Vacuum-cleaner manufacturers also report very good sales. The fractional-horsepower motor several months ago ceased to be the drug on the market it was a year previous, and now manufacturers are getting back into production on it. Competition is still strong, however, and prices have shown no indication of going up.

The field for industrial motors is being increased by the necessity of cutting down production costs. Where manufacturers can be shown that the use of one electric motor will dispense with the labor of two or three men it is not hard to sell the motor. This is the policy one manufacturer is going on, and he is meeting with success. Sales of industrial sizes seem to be well divided between the various territories. The East reports good sales throughout April, while a better demand is noted in New England for sizes of 5 hp. and below. The textile strike there is impeding movement to some extent as the mills are heavy users of motors Sales in Atlanta have been somewhat spotty, but inquiries are good and there is the prospect that demand will show a sharp upturn soon. Middle Western orders have been good since the first of March, one company reporting March sales to have been the best in eight months. On the Pacific Coast there are many inquiries for pumping-plant work, though the second-hand motor business there has been rather slow. Stocks are good in all sections of the country and prices are firm.

March Electrical Exports Go Ahead of Previous Month

ELECTRICAL exports for March showed a substantial increase over those for the preceding month, the total being $4,927,984 as against February's total of $4,184,677. This is still far below the amount for the corresponding month last year, which was $9,782,045, but it at least indicates that the bottom of the curve has probably been reached. Several factors will be at work during the next few months to increase exports, the most important being seasonal construction activity. South America and the Far East are buying more now, and Europe also will be more active as measures are taken to restore political peace

ELECTRICAL EXPORTS FOR MARCH, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	March, 1921 Volume	March, 1921 Value	March, 1922 Volume	March, 1922 Value
Electrical glassware, except for lighting, lb.	.....	.....	82,475	$16,071
Electrical porcelain, lb.	.....	.....	876,852	176,323
Carbons for lighting, electrodes and batteries, lb.	.....	$51,583	619,158	54,451
Insulated wire and cable (iron and steel) lb.	.....	.....	170,436	27,692
Other manufactures of aluminum, lb.	.....	156,038	271,774	86,082
Copper wire, lb.	984,878	199,165	1,344,995	198,661
Insulated wire and cable, lb.	.....	721,647	554,952	129,002
Generators:				
Direct-current—				
Under 500 kw., number	.....	.....	662	34,108
500 kw. and over, number	.....	.....	759	72,549
Alternating current—				
Under 2,000 kw., number	.....	.....	9	23,081
2,000 kw. and over, number	.....	.....	5	143,866
Accessories and parts of generators, lb.	.....	.....	70,690	22,148
Self-contained lighting outfits, number	.....	.....	85	25,165
Batteries:		412,019		
Primary, dry, number	.....	.....	446,739	110,108
Primary, wet, number	.....	.....	351	1,512
Storage, number	.....	.....	8,802	117,147
Transforming or converting apparatus:				
Power transformers, number	.....	.....	836	298,379
Other transformers, number	.....	.....	2,709	19,607
Rectifiers, number	.....	.....	90	2,907
Condensers, double-current and motor generators, dynamotors, etc., number	.....	.....	764	44,579
Transmission and distribution apparatus:				
Switchboards and panelboards, except telephones, number	.....	.....	182	65,125
Switches and circuit-breaker, number	.....	.....	138,106	150,212
Fuses and fuse plugs, number	.....	.....	110,283	11,187
Watt-hour and other measuring meters, number	.....	.....	6,340	51,954
Volt, watt and ampere meters, other recording, indicating ond testing apparatus, number	.....	.....	6,930	61,316
Lightning arresters, choke coils, etc., number	.....	.....	1,276	26,628
Motors, starters and controllers:				
Motors, under 1 hp., number	.....	.....	3,431	72,441
Stationary motors—				
1 hp. to 200 hp., number	.....	.....	1,723	178,902
Over 200 hp., number	.....	.....	22	66,682
Railway motors, number	.....	.....	18	5,420
Electric motors, number	1	4,400	.....	.....
Railway, number	.....	.....	.....	.....
Mining and industrial, number	.....	.....	7	14,553
Other motors, number	.....	1,571,601	396	19,738
Rheostats, controllers, etc., lb.	.....	87,649	101,653	52,216
Accessories and parts for motors, lb.	.....	.....	206,848	87,827
Electrical appliances:				
Electric fans, number	6,607	180,039	6,163	112,302
Electric lamps—				
Arc, number	176	2,878	543	1,990
Incandescent—				
Carbon-filament, number	91,907	20,435	22,122	5,402
Metal-filament, number	894,530	296,177	583,237	164,681
Other electric lamps, number	.....	.....	15,432	11,908
Flashlamps, number	.....	.....	24,487	22,602
Searchlamps and projection, number	.....	.....	1,260	12,403
Motor-driven household devices, number	.....	.....	1,896	49,877
Domestic heating and cooking devices, number	.....	180,693	13,912	48,123
Industrial electric furnaces and ovens, number	.....	.....	26	25,536
Therapeutic apparatus, etc., number	.....	.....	496	47,480
Signal and communication devices:				
Radio and wireless apparatus, lb.	.....	.....	8,608	21,180
Telegraph apparatus, including wireless, lb.	.....	352,714	.....	.....
Telephone apparatus including switchboards, lb.	.....	.....	326,543	519,442
Police, fire and burglar alarm, lb.	.....	.....	784	524
Railway signals, switches, etc., lb.	.....	.....	84,399	43,857
Bells, buzzers and annunciators, number	.....	.....	3,187	3,554
Other electric apparatus:				
Spark plugs, magnetos, etc., lb.	.....	112,534	88,613	94,413
Insulating material, lb.	.....	.....	237,679	80,139
Metal conduit, outlet and switchboards, lb.	.....	.....	149,869	16,832
Sockets, outlets and receptacles, number	.....	.....	69,639	16,079
Other wiring supplies and fixtures, lb.	.....	200,096	156,866	77,357
Other electric apparatus not elsewhere specified, lb.	.....	3,093,735	2,825,463	1,079,664
Total	.....	*	.....	$4,927,984

* Total electrical exports for March, 1921, amounted to $9,782,045. This figure is not included in the above table because of the incompleteness of figures for that month under the new classification.

there and also to bring Russia back into the economic fold. Increases over the previous month are shown by a large number of items, among the most important being copper wire, alternating-current generators, self-contained lighting outfits, batteries, transformers, stationary motors, fans, appliances of various sorts and the several kinds of wiring supplies. The most conspicuous decreases were registered by electrical porcelain, insulated copper wire and cable, transformers other than power, switches and circuit breakers, railway motors, and radio and wireless apparatus. The last-named item dropped from $283,950 in February to $21,180 in March. However, this was probably due more to inability to make deliveries than to lack of demand.

Such items as the new classification permits to be compared with the same month last year are found to be much lower than the March, 1921, totals. Insulated wire and cable were exported to the amount of $129,002, as compared with $721,647 the previous March; rheostats and controllers to the amount of $52,216, against $87,649; miscellaneous motors, $19,738, against $1,571,601; metal-filament lamps, $164,681, against $296,177; electric fans, $112,302, against $180,039, etc.

Importation of Irons Infringing Marsh Patents Restrained

ON APRIL 29, 1922, a final decree by consent was entered in the United States District Court for the Southern District of New York restraining the Benco Exporting & Importing Company, New York, from further infringement of the Marsh patent covering electric resistance elements. The defendant in this case was alleged to have been selling certain electric heating devices infringing the Marsh patent which were imported from Austria.

This news is particularly interesting in view of the fact that there has been much discussion recently of the volume of German-made electrical flatirons being imported into the United States. This decision, it is believed, should cut down the flow to some extent and should protect those manufacturers operating under the Marsh patent. However, it is probable that a large percentage of the electric flatirons being imported do not use the nickel-chromium alloy resistance element, and the importation of these, of course, will continue.

Good Business on Large Insulators with Strong Competition on Pin-Type

MANUFACTURERS of insulators report good sales of the high-tension suspension type recently, with good inquiries for deliveries ranging over the next three months. This increase in business is ascribed only partly to the decrease in price on suspension-type insulators which went into effect about the middle of March. In fact, this demand would probably have been just as large if there had been no price cut at all. Many of the high-tension lines in the West and on the Pacific Coast have got beyond the talking stage and orders have finally been placed for insulators and other line material, irrespective of price. As one manufacturer points out, once a central-station engineer has found a particular insulator fitted to his line and climatic conditions he is apt to specify that insulator on new jobs, regardless of whether the price is a few per cent lower or higher.

It is possible, in the opinion of more than one insulator maker, that the present demand is seasonal to a large extent. However, it is hoped to book enough orders now to tide the operating plants over until late in the fall, at which time sales forces can get out after next spring's business. There is reason to believe that it will work out in that way, for now that central-station companies have started building they have embarked on a program that will take three to five years to complete.

A price increase of about 5 per cent on the suspension type would not surprise many observers of the market. At the time the last decrease was effected there was talk of it being unjustified by costs. Since that time labor costs have shown a tendency to rise, while raw material also is in a firmer position. The coal strike has not embarrassed manufacturers so far, but if prolonged several months may cause some trouble.

There is plenty of business to be had in the pin-type insulator, but practically all of it is at buyer's price. It is the usual procedure for a buyer to call up and say that he will buy so many insulators at such and such a price, usually much below list, and secure shipment almost on his own terms. Some of the larger companies have been turning down business of this type rather than lose on it, but there are a number of smaller producers who operate under the advantage of a smaller overhead and can afford to accept these prices.

Metal Market Situation

THE copper market in the past week has been quiet, but prices remain firm and the position of producers, at least as far as statistics are concerned, is improving steadily. Stocks of blister copper are down to the minimum that can be safely carried as a reserve, and stocks of refined are no longer so large as to menace the market. Current output is increasing but not at such a pace as to outdo both foreign and domestic demand. Electrolytic now is quoted at 13 cents per pound for prompt delivery and at 13⅛ cents for June, July and August delivery. The export price is 13 cents f.a.s. New York. France and Germany have placed most of the foreign orders of the last week, but a good-sized order for castings for China was placed also. Business in finished products is increasing steadily, though a conservative tone is still noticeable among purchasers. Wire and rods are stronger, and quotations have gone up ⅛ cent. In the outside market copper for interior shipment is meeting some demand and prices are firm.

Exports in March were much heavier than estimated, Government returns showing an outgo of 78,236,480 lb. exclusive of outgo to Canada. Estimating April exports at 52,000,000 lb., the total of foreign deliveries during the first four months has been approximately 237,000,000 lb., exports during the first quarter having been 185,000,000 lb. March exports were the heaviest since May, 1920.

Steel orders have fallen off about 20 per cent in the last two weeks. During the first part of April consumers were rushing to cover, and now that the needs of the next ninety days are cared for demand is dropping off. This is not unexpected, and as a matter of fact some producers are worrying more about filling orders than about new business.

The lessened eagerness of buyers has brought out some cheaper offerings of lead in the Western outside market, prompt lead being quoted at 5.20 cents, East St. Louis basis, and it is probable that this price can be shaded. There have been various outside lots heard of in middlemen's hands in various parts of the country, such as usually crop up after an advance. The New York position is firm, though demand all around is momentarily quieter. The main features of the situation, however, are still unchanged, consumption evidently being in full volume and producers booked well ahead.

NEW YORK METAL MARKET PRICES

Copper:	April 25, 1922	May 2, 1921
London, standard spot	£ s. d. 59 0 0	£ s. d. 60 2 6
	Cents per Pound	Cents per Pound
Prime Lake	12.87½	13.00
Electrolytic	12.75	12.87½
Casting	12.50	12.50
Wire base	14.00 –14.25	14.12½–14.37½
Lead, Am. S. & R. price	5.25	5.25
Antimony	5.12½	5.37½
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.35 –5.40	5.35
Tin, straits	31.12½	31.25
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00 –11.12½	11.00 –11.12½
Brass, heavy	5.25 – 5.50	5.25 – 5.50
Brass, light	4.87½– 5.12½	4.87½– 5.12½
Lead, heavy	4.25 – 4.37½	4.50 – 4.62½
Zinc, old scrap	2.50 – 2.75	2.50 – 3.00

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE electrical industry still remains guiltless of high spots, with the exception of wiring material and radio demand, both of which are far ahead of other electrical items. Good building conditions are reported from all sections, with building trade troubles diminishing. St. Louis union carpenters have accepted a reduction of 15 per cent and the situation there is somewhat relieved. Contractor dealers are finding plenty of house wiring and some little commercial wiring to take care of, but industrial work still lags.

An opportunity to secure radio-transmitting vacuum tubes is offered by the Navy Department, which on May 15 will open bids for 30,000 type C. G.-1162 tubes. These tubes, which are several years old, can be used for receiving and amplifying by reslotting the receiving-tube socket. The tubes are to be resold by the purchaser only under certain conditions laid down by the government.

NEW YORK

Sales of the general line of wiring supplies continue to hold up well, and the jobbers report that business is gaining gradually. Individual orders are increasing somewhat in size, and some fairly large orders for conduit for future requirements have been placed. The revival of building activity offers still more encouragement as there seems to be no let-up to the new construction which is being put under way. Although the demand for electrical material from industrial users is backward, jobbers who specialize in this branch of the trade say that orders from their customers of this class are slowly increasing.

Stocks in all lines are fair to good, and so far as could be learned there is no shortage on anything except radio apparatus, and on this a shortage is to be expected. The only change in prices was on outlet boxes, on which quotations have been increased about 50 per cent. Conduit prices are somewhat elastic, as several jobbers are offering pipe in large quantities on the basis of card 49. This is accounted for, however, by the fact that the last increase in quotations was anticipated by both jobbers and contractors. Conduit manufacturers are reported to be rushed with work to catch up with these orders.

Rigid Conduit.—Some large orders have been placed for this material, and the increase in building in the business sections has materially stimulated the demand for it. Jobbers have been slow to put the new prices in effect as they had placed fair-sized orders before the last increase. It is expected that by the last of the week the new quotations will be pretty well established. Quotations ranged as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-covered Wire.—Prices remain unchanged, and there is a fairly active demand. In 5,000-ft. lots No. 14, rubber-covered, sells for $6.25 to $6.38 per 1,000 ft. Quotations as low as $6.15 per 1,000 ft. have been made on lots of 10,000 ft. and over.

Flexible Armored Conductor.—Demand is active and steady, with jobbers' stocks in fairly good shape. Quotations on No. 14, two-wire, single-strip, are from $43 to $45 per 1,000 ft. and from $45 to $47 on double-strip.

Outlet Boxes.—An increase of over 50 per cent in the price of outlet boxes has been announced. Black boxes in standard-package lots on which the discount was formerly 75 per cent are now quoted at 60 to 62 per cent discount. On galvanized boxes in standard-package lots the discount has been reduced from 70 per cent to 55 to 57 per cent.

Metal Molding.—A fair demand is reported. In small quantities the three-wire size sells for $5.60 per 100 ft., while in quantities of 1,000 ft. or more a price as low as $50 per 1,000 ft. has been quoted.

Dry Cells.—Batteries are moving well. No. 6 regulars are quoted at $29 per 100 in barrel lots of 125 and igniters at $30 per 100 in the same quantity.

Radio.—There is a little more of this material available now, although jobbers report that they have no stocks on hand. It is expected that the summer months will afford an opportunity for the trade to catch up with the demand.

CHICAGO

Business for the past week has been steady and about equal to the activity in the electrical trade of the previous weeks. With each day's increase in building permits the demand for wiring materials has improved. While the volume of sales has been good, the unit of sale has been in small lots. Competition on conduit has resulted in jobbers maintaining the old price until their present stocks are sold. Manufacturers of high-tension equipment report another good week of business and state that inquiries are increasing. The farm-lighting equipmen manufacturers have noticed an improved sentiment toward their equipment and state that the 1922 outlook is more encouraging than last year's. Along with the building boom comes a better activity in house lighting fixtures. Contracts for new passenger equipment to cost about $1,000,000 have been let by the Wabash railroad.

Wire.—Although no startling changes in the call for wiring materials occurred this week, the demand has equaled the steady stocking of this material during the past few weeks. Where one dealer will report a spurt of activity, others will state that the volume is good without any pronounced outstanding sale. Taken as a whole, the movement has been satisfactory and most jobbers are pleased with the better business prospects. Rubber-covered No. 14 is still available in 5,000-ft. lots for prices averaging around $6.25 per 1,000 ft. Stocks are ample. The demand for weatherproof and bare wire has also held its own, but prices have not changed.

Rigid Conduit.—The new prices on conduit have not gone entirely into effect since jobbers prefer to move their present stocks at the old prices because of the active price competition. Accordingly the price varies from $41 to $43 per 1,000 ft. of ½-in. black in 5,000-ft. lots. Stocks are reported good. The demand is steady and the volume of sales also is good.

Flexible Armored Conductor.—This is continuing its good movement and jobbers' stocks are fair. It is quoted at $42.50 per 1,000 ft. in 5,000-ft. lots.

Farm-Light Equipment.—While conditions in this industry still appear rather sluggish, several manufacturers have stated that the 1922 outlook appears much more encouraging than it did in 1921. At the present time the farmer is naturally very much interested in planting, but the organizations out after the business report a better feeling on his part. The increase in the value of his products has made him interested in this equipment, and dealers state that inquiries are increasing.

Poles.—The pole activity is being sustained by replacements and extensions of the utility companies. However, the demand is variable, and dealers report their business is good in certain spots only. Most of them are optimistic and report that they are receiving their share of the business. No price changes have occurred recently and stocks are good.

Pole-Line Hardware.—This naturally follows the demand for poles and is also moving well. Stocks are ample.

BOSTON

Business is uneven between different jobbers, but on the whole a marked improvement is reported as compared with a few months ago. The expansion of the building industry continues to be the brightest feature of New England commercial activity. For the week ended April 25 the total building and engineering contracts reported were $12,924,400, compared with $4,804,100 a year ago and $7,796,000 for the corresponding week of 1920. The present total is from two to three times the same week's showing in nearly every year back to 1902. Residential building is much more active than industrial construction, and considerable mercantile and banking work is being done by builders. The paper industry is busy in this section. Labor troubles still throttle progress in the textile industry in certain localities, and a lockout has been declared by Lynn shoe plants pending completion of existing orders and the acceptance of a 20 per cent wage reduction. Retail trade is better and the demand for radio apparatus grows like Jonah's gourd. Credit conditions are not so good as in March among electrical supply jobbers. Central-station earnings are holding up well, with strong tendencies toward increased outputs. Prices did not exhibit marked changes during the week, barring the stiffening of rigid conduit quotations indicated a week ago, which has now found its place on jobbers' sheets.

Lamps.—Continued good business in lamps of various sizes and types is reported. Interest in house wiring is spreading over wide areas as a result of vigorous publicity, central-station campaigns and such displays as the recent "Home Beautiful" show at Boston, which on a recent evening attracted an attendance of 10,000 persons. Prices of lamps are steady.

Radio Apparatus.—Deliveries are falling behind on vacuum tubes and telephone receivers for wireless service. So great is the popular demand that thefts of apartment-house telephones not designed for radio work are being reported. Broadcasting service is becoming more diversified, with corresponding enlargement of popular interest in equipment. Much material of dubious quality is now being marketed by non-electrical concerns lacking technical knowledge of radio requirements.

Motors.—A light business is being handled, with occasional streaks of encouragement. One Boston jobber recently disposed of $1,000 worth of moderate-sized motors in a single order, but on the whole this business is of the piecemeal character.

Rigid Conduit.—Prices have advanced around 5 to 10 per cent, and the new quotations effective last week may be typified by the following figures per 1,000 ft. and in 500-ft. to 5,000-ft. lots: Black, ½-in., $51.89; galvanized, $56.99; black, 1-in., $95.28; galvanized, $105.48. Elbows per 100, in 500-lb. to 5,000-lb. lots, are quoted: Black, ½-in., $10.84; white, $11.98. The corresponding 1-in. figures on elbows are $21.22 and $23.33. Couplings per 100, in the above range of lots, are quoted as follows: Black, ½-in., $5.18; galvanized, $5.50; for 1-in. elbows, $9.63 and $10.41. Prices above 5,000-ft. on rigid conduit are open in the smaller and more common sizes.

Wire.—Rubber-covered wire is moving moderately well at $6.25 per 1,000 ft. in 5,000-ft. lots, and weatherproof is doing fairly well at from 15 to 16 cents base, according to quantity. Little bare copper wire is selling except for radio aerials, and the recent scarcity of No. 14 bare is now being relieved by better deliveries.

ATLANTA

A break in the inclement weather has served to improve materially the outlook throughout this section, with a resultant stimulation in business in almost all lines. Planting has got under way, and payments for fertilizer and labor on the farm are being reflected in the increased volume of business of the small town merchants. They in turn are placing orders for larger stocks and are liquidating some of their back debts.

The larger electrical contracting firms report considerable industrial activity, with inquiries showing a heavy increase and actual orders being placed for expansions and improvements. One of the largest Southeastern power companies is actively undertaking the sale of large blocks of power to industrial plants in this section in anticipation of the completion of hydro-electric developments now in the process of construction. This will, of course, in a reasonable time stimulate the sale of electrical construction material, motors, high-tension transformers and so forth. In short, the outlook is brighter than for many months past.

Fuses.—A steady movement in this line is to be noted with the popularity of the renewable type on the increase. There still continues a steady demand for the standard and plug types, the price on plug fuses being quoted at $22.50 per 1,000 in large lots.

Armored Conductor.—The construction of small commercial buildings and the wiring of old houses is causing a brisk demand, the price on two-wire No. 14 being $52 per 1,000 ft., with an advance of about 5 per cent predicted. Local stocks are in good shape.

Bell-Ringing Transformers.—This specialty is for some reason moving more slowly than was anticipated, though the heavy residential construction in the section should materially stimulate sales soon. Reetailers' price on the small size is steady at $1.30.

Radio Sets.—All radio equipment continues in heavy demand with supplies insufficient to meet present needs. A growing tendency toward the higher class of equipment is to be noted with amplifiers making steady gains. A number of retail outlets have opened up recently, and one of the largest jobbers announces active entrance into the field beginning May 15.

Meters.—The movement of meters is fair to good, with the 5-amp. and 10-amp. types most in demand. Orders for high-tension equipment are rather slow. Jobbers' and distributers' stocks are in splendid shape with prices steady.

Outlet Boxes.—Sales are very satisfactory in all the popular sizes. A price advance of approximately 5 per cent is reported this week. Jobbers' stocks are ample for present purposes.

Flexible Non-Metallic Conduit.—Activities are reported fair to good with supplies on hand somewhat in excess of the near future demands.

Wire.—Both weatherproof and rubber-covered wire are active, particularly in the No. 12 and No. 14 sizes, with all sizes smaller than No. 6 weatherproof moving rapidly. Several very fair orders for heavy cable have been placed recently by local contractors. The general opinion is that wire prices are at their low ebb.

Wiring Supplies.—There is some increase in activity, with price reductions of 10 per cent announced in snap and push-button switches. Sockets are quite active and stocks throughout the line are good.

ST. LOUIS

Construction work is expected to be somewhat stimulated as a result of arbitration of carpenters' wages in St. Louis, a reduction from $1.25 to $1.10 per hour being agreed upon. Notwithstanding the reductions which have been made in building wages, there is still a marked feeling among those contemplating building that costs of labor and materials are too high, and a considerable amount of work is being withheld for lower prices.

A recent survey made by the St. Louis Federal Reserve Bank of the general character of trade in this territory indicates that conditions have become more stable in regards to stocks and prices and that the public is in need of commodities of all sorts. Stocks in the hands of retailers continue abnormally low, and, on the other hand, manufacturers are increasing their purchases of raw materials and are beginning to accumulate finished goods in anticipation of increased demand later on. Plentiful and easy money is tending to broaden manufacturing programs. The coal strike has had no appreciable effect on business so far. Marked improvement is noted in the steel mills and in the foundries, their operations being heavier now than they have been at any previous time in the last eighteen months.

Wire and Cable.—Actual sales were about the same last week as they have been for some time, but inquiries were more numerous and for larger amounts. The central-station companies are obtaining prices on bare and weatherproof, indicating early opening of line construction work. One power company is in the market for a large amount of 27,000-volt, three-conductor underground cable. Stocks of wire are conservative and prices are firm. No. 14 rubber-covered is priced at $6.25 per 1,000 ft. in 5,000-ft. lots.

Transformers.—Considerable improvement is found in the demand for distribution transformers, and there were a few sales in this territory last week of 13,200-volt transformers. Inquiries for all sizes and voltages are much more plentiful and indicate that there will soon be a very good demand.

Lightning Arresters.—From the inquiries received it appears that there will be quite a bit of protective equipment installed in this territory this spring. Orders have been received in increasing amounts for several weeks, and the volume of business this season is expected to be substantially better than last year.

Appliances.—Sales were comparatively quiet from the first of the year until Easter, but it is reported that there has been appreciable improvement in the last two weeks, and April sales are expected to compare favorably with those of last April. The new mode in hairdressing has resulted in heavy sales of curling irons. Flatirons, vacuum cleaners and washing machines are in good demand. Percolators are not moving so rapidly as was anticipated, but improvement is expected as spring weddings come on.

SAN FRANCISCO

The predicted wave of depression has not hit California seriously, and retail trade holds up very well compared with previous years. With summer approaching and crop sales near there seems good reason to believe that the worst of the depression has been passed.

Motors.—Farmers and growers who have held off purchasing pumping equipment as long as they dared are now buying well, and as nearly all crops are heavy and prices are high there is excellent business reported in motors from 5 hp. up to 25 hp. All motor business is, in fact, heavy. The California district contains an increasing number of industrial plants that also need motors, and there is much remodeling in accordance with the increased knowledge of scientific plant layouts. Coast stocks accumulated during a season of slack demand are still high but are decreasing very nicely.

Appliances.—Retail buying is better. Dealers and department stores are placing good stock orders in expectation of a "June bride" demand that is expected to be better than for several years past. Stocks of percolators are again being purchased by dealers who have hitherto managed to get along fairly well on carryover. Recent improvements in many standard lines have been a powerful incentive. Furthermore, considerable business has been created by amusement parks which operate concessions that give percolators as prizes.

Household Appliances.—It is probable that the recent interest in radio equipment has taken a good deal of money that would otherwise have gone into the purchase of some of the larger household appliances. Moreover, it is still necessary to gain the greater part of this business by door-to-door solicitation. This continual bother of solicitation is reflected in the fact that certain dealers have found it necessary to increase the commission rate from 20 to 25 per cent. Many experts believe that eventually this business will return to the stores which do not employ such soliciting crews, but for the present at least solicitation is necessary.

Ranges.—The building of distribution lines is reflected in the present good pole-line hardware business, and it will soon be reflected also in electric range and water-heater sales. Entire districts lying in pockets between the old distributing systems are now being reached by lateral lines and have been signed up for range service even before the service has reached them.

PORTLAND—SEATTLE

Business in general seems to be improving as a result of recent fine weather. A slow but gradual improvement continues to manifest itself in the major lines of industry. The lumber industry, of primary importance in the Northwest, is more nearly on a normal basis than at any time during the past eighteen months. Production during April was not over 7 or 8 per cent below normal, and production for the week ended April 22 was only 5 per cent below normal, with new business 17 per cent above production and shipments practically equal to new business. Building of all kinds, and particularly residence construction, highway construction and improvement and maintenance work by the railroads, is very active throughout the Northwest.

In the electrical trade business seems to be getting gradually better. Inquiries are increasing steadily, and the prospects generally look brighter. The lumber mills have used up most of their surplus stocks and are again active buyers. Motors, in sizes up to 10 hp. especially, have been moving more actively. Prices for the most part seem to have reached a condition of stability. A 5 to 6 per cent drop in pole-line hardware is reported to have become effective during the past week. The demand for house wiring and schedule material is good, owing to the large amount of residence and apartment construction. Dealers of Portland report a demand for vacuum cleaners and ranges.

Fuses.—There is a steady and somewhat increasing demand for material of this class. Prices remain steady as follows: 30-amp. plug fuses, $3; 30-amp. non-renewable fuses, $10.20; 30-amp. renewable fuses, $29; 60-amp. non-renewable fuses, $18; 60-amp. renewable fuses, $58. All prices are for quantities of 100 in lots of 500.

Tape.—This item is a staple and enjoys a steady demand. Present quotations run from $24.75 to $25.85 per 100 rolls in lots of fifty rolls or less. Rubber tape is quoted at $23.50 in similar lots.

Lamps.—The lighting season is about over, and present sales are accordingly slow. The past season has been considerably better than the season a year ago. The tendency toward the use of larger sizes has been particularly evident, the 75-watt and 100-watt sizes having assumed the position of best sellers formerly held by the 25-watt and 40-watt sizes.

SALT LAKE CITY

The labor situation at the coal fields has not been very favorable during the past week. A crisis arose in Utah that threatened an emergency call of the National Guard, but the agitation is dying down now.

Non-employment is growing less widespread as construction work gets under way. Home building is proceeding at a good rate. The housing problem by the end of this season should be pretty satisfactorily solved so far as emergency demand is concerned.

Unprecedented interest is being manifested in convenience outlets in both old and new homes. Contractor-dealers report more business in this line than in any year of their history. The increased demand is believed to be largely the result of the electric home demonstrations that have been conducted in the larger centers. Materials of all kinds are ample to meet the demand.

Washers.—The spring demand thus far has been good with prospects for disposal of many more machines. Improved models are now on the market at little or no advance in price. Stocks are good in most makes with manufacturers making steady deliveries.

Cleaners.—Sales made thus far in 1922 exceed sales for the corresponding period of 1921 by a good margin. Stock shortages have developed in one or two instances where big advertising campaigns were launched without adequate preparation. No price changes of recent date have been noticed.

Hollow Ware.—Dealers are stocking well in anticipation of good sales in May and June, the two months of weddings and wedding gifts. The regular trade is fair and stocks are ample.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Wage Raise by Brass Manufacturer

The Ansonia Manufacturing Company, brass manufacturer, Ansonia, Conn., has announced a 15 per cent wage increase to become effective May 15. The increase affects between 500 and 600 employees. The company made a cut in wages about a year ago, but promised at that time to rescind the cut whenever business conditions justified.

Carter Electric Quarters Increased

The Carter Electric Company, 112 South Washington Street, Kokomo, Ind., recently moved into its new two-story building, which has a floor space of 10,000 sq.ft. The company has been in business since 1906 and was incorporated in January, 1920. The officers are: O. B. Carter, president; Hugh Duncan, vice-president, and John Carter, secretary-treasurer.

Westinghouse Increasing Output of Radio Outfits Rapidly

The Westinghouse Electric & Manufacturing Company, according to officials, is now turning out 500 complete radio receiving outfits daily, and production is being increased as fast as additional facilities can be provided. The company expects to have production up to 1,000 sets a day in the next two or three months. After that the management will be in a position to determine to what extent expansion should be carried out. Preparations are being made to turn out a large quantity of vacuum tubes at the New Jersey lamp factory as demand for tubes is still far ahead of supply. The manufacture of receiving sets has been concentrated at the Springfield (Mass.) plant.

Form Company to Manufacture Dishwashers

The formation of the Murdoch Dishwashing Machinery Company, Marion, Ohio, has been announced. The company has a capital stock of $250,000 and is backed by business men of Marion and Bucyrus, Ohio. Offices and factory space have been obtained in Marion, and the company will go into production of a complete line of power dishwashing machinery, the line to include commercial types and an electrically driven household machine. The officers are: H. A. McKinnon, president and manager; Millard Hunt, first vice-president; C. A. Murdoch, second vice-president; Fred B. Scherff, secretary, and F. B. Fidler, treasurer. C. A. Murdoch, designer of the machines, will have charge of the engineering sales department.

Wagner Electric Announces Plans for Reorganization

The Wagner Electric Manufacturing Company, St. Louis, is planning to issue $2,000,000 in preferred stock, which will be offered to the present common-stock holders pro rata at par. This information comes in a statement to the ELECTRICAL WORLD authorized by W. A. Layman, president. As under the laws of the State of Missouri preferred stock can be issued only with the unanimous consent of every shareholder of the corporation, and as considerable time would be required to gain such unanimous consent, it is probable the new financing of the company will provide for the formation of a corporation under the laws of some other state with provisions for both preferred and non-par common stock, with an exchange of shares by the stockholders of the present corporation for the stock of the new corporation. The details of the plan will be announced shortly.

The present company was organized in 1891 and has an authorized capital stock of $7.500 000, of which approximately $5,800,000 is now outstanding. The business of the company is reported to be making substantial improvement in all its branches. Since Jan. 1, 1921, the company's obligations have been reduced approximately 43 per cent, and with the new financing the floating debt of the company will be very largely paid off. Whether there will be any change in management of the company has not been announced.

United States Steel to Build Tube Plant

Plans of the United States Steel Corporation to erect a fifteen-million-dollar plant for the manufacture of lap and butt weld tubes at Gary, Ind., have been announced by Elbert H. Gary, chairman of the Steel Corporation. The plant is to be built by the National Tube Company and will be financed partly by the issue of $10,000,000 of bonds and partly from the cash surplus of the Steel Corporation. The capacity of the new plant will be about 350,000 tons a year, adding between 20 and 25 per cent to the corporation's present tube capacity.

Work is to be started immediately, and it is expected that production will be begun in about two years.

General Electric Orders Running Ahead of 1921

If the General Electric Company receives orders during the remainder of 1922 at the rate they were received during the first quarter, total sales for the year will amount to over $200,000,000. This total would be $20,000,000 larger than the total for 1921, but not quite up to the actual billings of that year, which were $221,000,000. This difference is due to the fact that orders on the books on Jan. 1, 1922, amounted to only $45,391,000, or just sufficient to keep the plant running ten weeks, as against sufficient unfilled orders at the beginning of 1921 to keep the plant in operation for six months.

It was stated recently at a meeting of officials of the Lynn works of the company that business, while still subnormal, is better by about 15 per cent than it was on the average during 1921. Good orders for large apparatus are being received, demand being noted for large steam turbines, large generators and large industrial motors. Small devices are not selling satisfactorily, with the exception of meters, while sales of induction and railway motors are still low. Orders for switchboard apparatus are almost up to normal.

Consider 1923 Fixture Market Location—Possibly Permanent

Among the problems discussed at the recent joint conference committee of the Associated Lighting Industries—the National Council of Lighting Fixture Manufacturers, the Lighting Fixture Dealers' Society of America and the Illuminating Glassware Guild—was that of the 1923 Lighting Fixture Market. Up to the present time each successive annual event has taken place in a different city, but the committee has decided that the "fixture market" has now grown to such dimensions that it is desirable to consider the establishing of a permanent location for this big annual event. The committee has therefore recommended that this idea of permanency should be kept in mind in the plans to be considered for the 1923 market, to be held the fourth week in January.

The idea of a permanent fixture market seems to appeal greatly to a large number of fixture men, the committee states. The strikingly successful prototype of the Lighting Fixture Market, the annual furniture market at Grand Rapids, proves that a permanent location gives to such events a stability and a prestige which a movable exhibit cannot attain, and that, moreover, a fixed location from year to year produces a larger dealer attendance than would otherwise be the case.

Before deciding therefore on the city to be selected for the coming market, a particularly careful survey is to be made of the railroad facilities, hotel accommodations and other requirements for a successful location among the various cities suggested.

An important point about a permanent fixture market, it is pointed out, is the reduction of the expense of booths and other installation costs, for under present conditions thousands of feet of lumber and other material are required for each market, and these cannot be used again. Moreover, with a permanent location it would be possible to maintain a completely organized department to look after the details of the market.

Mercury Company Reports Sales in Japanese Market

The Mercury Manufacturing Company, manufacturer of electric industrial tractors, 4118 South Halsted Street, Chicago, reports that the Japanese market is in a very receptive mood at the present time and that manufacturers of labor-saving machinery are finding an especially good demand there. The rapid rise of Japan as an industrial nation, the company states, has made it imperative to supplant manpower with mechanical means wherever possible.

AMERICAN ELECTRIC TRACTOR IN WAREHOUSE SERVICE AT KYOTO, JAPAN

The Mercury company has recently installed a fleet of electric tractors for the Sugimara Warehousing Company, Kyoto, Japan, through the Kawakita Electric Corporation, machinery importers, Tokio, Japan. One of the tractors is shown in operation in the accompanying photograph. The fleet consists of four Mercury tractors and a number of warehouse trailers.

Electrical Material Company in Larger Quarters

The Electrical Material Company has removed its offices and factory from 618 West Jackson Boulevard, Chicago, to 158 West Lake Street in that city. The company will occupy all four floors of the West Lake Street building. The move provides greatly enlarged quarters, made necessary by an increase in business. A. F. Henderson is president.

Radio Manufacturers Organize Chamber of Commerce

Leading manufacturers of radio apparatus and equipment held a meeting in New York on April 28 to perfect the plans for a National Radio Chamber of Commerce. The membership of the organization is open to all established and responsible companies. About fifteen concerns so far are members, among which are the De Forest Telephone Company, the Freed Eiseman Radio Corporation, the Jewett Manufacturing Company, the Home Radio Company, the Dubilier Condenser Company and the F. A. Andrea Telephone & Telegraph Company. In opening the membership to all established and responsible companies, it is announced, it is the purpose of the organizers to prevent as far as possible losses to the public through investment in unsubstantial enterprises, of which there are many.

Ansonia Electrical Holds House Warming at New Magnet-Wire Plant

A most interesting indication of the growth of the electrical industry was afforded on Thursday of last week at the house warming of the new enameled magnet-wire plant of the Ansonia Electrical Company. One of the oldest of electrical manufacturing concerns, this company developed in Ansonia, Conn., where it manufactured bells, annunciators and annunciator wire and cotton-covered magnet wire until it reached the point where it was so hedged in by the city that there was no more room for expansion. The officials of the company selected a few years ago a forty-five-acre tract outside Ansonia and built on it the plant just opened with a floor space of 54,000 sq.ft. Eventually all of the company's manufacturing operations will be removed to new buildings on this site. To the house warming were invited all of the company's Eastern and Middle Western agents. After inspecting the new plant dinner was served at the Hotel Taft, New Haven, where Thomas Wallace, president of the company, and William J. Tonkin, assistant secretary, were hosts. A number of interesting talks of economic and reminiscent nature were made, among them being addresses by Samuel Weldon, cashier First National Bank of New York City; Charles F. Brooker, chairman of the board of the American Brass Company, and R. S. Wildman, who is Ansonia manager of the Ansonia Brass Company.

The High Tension Insulator Corporation, Ballston Spa, N. Y., has been organized to manufacture high-tension insulators. The directors of the company include R. H. Dairson and William H. Namack.

The Simms Magneto Company, East Orange, N. J.. manufacturer of magnetos, starting and lighting systems and a portable lighting and power system, has opened a branch office and showroom at 5781 Woodward Avenue, Detroit. L. F. Acker has been appointed manager, and it is intended to cover the states of Ohio and Michigan from the Detroit office.

The American Insulating Machinery Company, Philadelphia, has moved its Paris office from 10 Rue de l'Elysée to 8 Rue Auguste Chabrières and has placed Richard Waller in charge. All Continental business with the exception of Scandinavian matters will be handled from this office.

The Diehl Manufacturing Company, Elizabeth, N. J., manufacturer of direct and alternating-current motors, generators, fans and exhaust wheels, has opened a Southern office and stock room at 45-A Trinity Avenue, Atlanta, under the supervision of J. H. Shahan, sales representative.

The Trumbull - Vanderpoel Electric Manufacturing Company, Bantam, Conn., has placed L. B. Underwood in charge of the Philadelphia office of the company, 139 North Fourth Street, the appointment taking effect May 1. Mr. Underwood has been in the New York and Connecticut territories for the company for the past two years. V. O. Lundgren will also be in the Philadelphia office. A complete stock of safety switches, radio switches and knife switches will be carried there.

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, has appointed C. M. Hall, formerly in charge of the New York territory for the Dodge Transmission Company, to take charge of sales in Cincinnati and Dayton, Ohio, and the States of Indiana and Kentucky. He will have headquarters in Indianapolis. Malcolm Grant has also joined the Black & Decker organization in a selling capacity and will have the State of Ohio with the exception of the corner which includes Cincinnati and Dayton. He will have his headquarters at the Cleveland office of the company.

Foreign Trade Notes

SIEMENS-SCHUCKERT COMPANY TO ERECT A PLANT IN JAPAN.—A contract, it is reported, has been concluded between the Siemens-Schuckert Company, one of the largest electrical engineering and construction companies in Germany, and the Japanese copper king, Furchawa, whereby both firms will erect a large plant at Tokyo for the manufacture of all kinds of electric generating machinery. Twenty engineers of the staff of the Siemens-Schuckert Company, together with a number of technical experts, have already left Berlin for Tokyo.

MARKET FOR ELECTRICAL HOUSEHOLD APPLIANCES IN ONTARIO.—The extension of electrical lines of the Hydro-Electric Power Commission throughout the rural districts in Ontario, Canada, according to *Commerce Reports*, is creating a demand for electrical household appliances among farmers, and it is stated that recently hardware merchants have begun to add electrical departments to their stores, whereas formerly only small electrical dealers catered to the trade.

Foreign Trade Opportunities

Numerous inquiries for electrical goods have been received by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., of which detailed information may be obtained by referring to Nos. 1407-1427, 1432, 1476, 1481, 1499, 1501, 1510 and 1517.

New Apparatus and Publications

INDUSTRIAL OVENS.—The Paul Maehler Company, 2,210 West Lake Street, Chicago, is distributing a thirty-four page catalog covering the "Maehler" industrial ovens, including annealing, core drying, enameling, japanning and lacquering ovens and also burner equipment and potash boiler furnaces for gas, electric, oil or steam heating systems.

OUTLETS.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing a four-page pamphlet calling attention to the "Hubbell" convenience outlets and other "Hubbell" devices.

BATTERY TESTER.—The American Bureau of Engineering, Inc., 2,632 Prairie Avenue, Chicago, is distributing a leaflet describing the "Ambu" three-ball battery tester for auto or radio storage batteries.

DESK LAMP.—A new "Esrobert" desk lamp, know as No. 310, has recently been placed on the market by S. Robert Schwartz & Brother, 729 Broadway, New York City.

SAFETY SWITCH.—A new type of safety switch has recently been developed by the Square D Company, 6,065 Rivard Street, Detroit.

TROUBLE LAMPS.—The Appleton Electric Company, 1,701 Wellington Avenue, Chicago, has recently developed two new models of "AutoReelite," model F, for use with inclosed cars and model G for open cars.

CONDUIT FITTING.—A new entrance fitting, type "BF," for 2½-in. and 3-in. conduit has recently been brought out by the Killark Electric Manufacturing Company, 3,940 Easton Avenue, St. Louis.

ORNAMENTAL POSTS AND TOPS.—Circular 1,642 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its "Cutter" ornamental posts and tops.

BOILERS.—The Heine Boiler Company, St. Louis, is distributing a pamphlet entitled "Forty Years of Progress," announcing a change in name and several new developments in boiler design.

MOTOR STARTER.—The Monitor Controller Company, Baltimore, is distributing a four-page pamphlet describing the monitor "Thermaload" starter for single-phase and polyphase motors.

FLOOR SURFACING MACHINE.—The American Floor Surfacing Machine Company, Toledo, Ohio, is distributing a folder describing and illustrating the "American Universal" electrically driven floor-surfacing machine.

ROTARY RECTIFIER.—A rotary rectifier with a capacity of 1,500 watts and capable of charging fourteen or sixteen 6-volt batteries at 15 amp. or thirty 6-volt batteries at 6 amp. to 8 amp has been placed on the market by the King Electric Manufacturing Company, Inc., Tonawanda, N. Y.

RENEWABLE FUSES.—"Shurvent Protection" is the title of folder 4,472, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covering its vented renewable fuses designed for the protection of low-voltage circuits up to 600 volts for both alternating current and direct current.

SAFETY SWITCH.—The Mutual Electric & Manufacturing Company, Porter and Fourth Avenues, Detroit, has placed a new "Bulldog" safety-type switch on the market.

New Companies

THE OREGON POWER COMPANY, Perrysburg, Ohio, has been incorporated with a capital stock of $25,000 by A. B. Harris, Howard Lewis, Milo J. Warner, Charles H. Lemmon and Charles T. Lewis, Jr.

THE CLYDE RIVER POWER COMPANY, Newport, Vt., has been incorporated with a capital stock of $150,000. This company is a consolidation of several power companies in northern Vermont. The officers are: George E. Hunter, Boston, president; David Barry, Boston, vice-president and general manager, and Charles A. Prouty, Newport, treasurer.

THE RANDOLPH-ANDREWS ELECTRIC COMPANY, 1140 East Street, Trenton, N. J., has been chartered by Charles F. Andrews, agent; Arthur S. Randolph and Chalmers E. Van Anglin. The company is capitalized at $100,000.

THE CONSOLIDATED ELECTRIC COMPANY, St. Paul, has been incorporated with a capital stock of $50,000. The officers are: Carl J. Gardeen, president; John Schudell, vice-president, and J. O. Nelson, secretary and treasurer.

THE ARION MANUFACTURING COMPANY, Boston, has been incorporated by Royal R. Sheldon, Samuel W. Sharmat and H. Leon Sharmat, all of Brookline, Mass. The company is capitalized at $100,000 and proposes to manufacture electrical supplies and musical instruments.

Record of Electrical Patents

Notes on United States Patents

(Issued April 11, 1922)

1,412,376. FAULT LOCATOR FOR ELECTRIC CABLES; Hugh M. Stoller, New York, N. Y. App. filed Aug. 17, 1920. Determines where test current stops flowing.

1,412,384. COMBINED CAR AND ELECTRIC COUPLING; Thomas R. Brown, Sparkill, N. Y. App. filed April 4, 1917. Switch for securing proper circuit relation throughout train.

1,412,385. SIGNALING SYSTEM; Theodore W. Case, Scipio, N. Y. App. filed Nov. 17, 1920. Transmitting and receiving light rays.

1,412,405. METHOD FOR TESTING TRANSMITTERS; Raymond R. Herrmann, St. Paul, Minn. App. filed Nov. 2, 1920. Mechanical means of testing telephone transmitters.

1,412,414. DRIVING MECHANISM FOR IGNITION GENERATORS; John L. Milton, Cleveland, Ohio. App. filed Feb. 6, 1918. Automobile magneto.

1,412,435. TELEPHONE TRUNK CIRCUITS; John Wicks, Chicago, Ill. App. filed June 11, 1917. Trunk-system control between automatic and manual exchanges.

1,412,458. MESSAGE REGISTERING SYSTEM; Leo H. Darrow, New York, N. Y. App. filed Dec. 23, 1918. Automatic switching device for toll service.

1,412,463. CONSTANT CURRENT ARC-WELDING SYYTEM; William B. Elliott and William O'Blenis, Westfield, N. J. App. filed March 14, 1918. By excitation adjustment of one generator by a second.

1,412,490. SIGNALING SYSTEM; William A. Rhodes, New York, N. Y. App. filed March 22, 1918. Telephone system for making connections between rural, local and long-distance lines.

1,412,511. ELECTRIC FURNACE; Ora A. Colby, Irwin, Pa. App. filed March 31, 1920. Resistance type.

1,412,512. ELECTRIC FURNACE; Ora A. Colby, Irwin, Pa. App. filed April 23, 1920. Resistance type.

1,412,513. ELECTROLYTE; John Coulson, Wilkinsburg, Pa. App. filed Feb. 19, 1917. For lightning arresters, comprising solution containing less than 2 per cent of ammonium carbonate.

1,412,514. ELECTROLYTE; John Coulson, Wilkinsburg, Pa. App. filed Feb. 19, 1917. For lightning arresters comprising solution of ammonium malate.

1,412,539. TELEPHONE; Robert L. Murray, Bushey Heath, England. App. filed Sept. 16, 1920. Transmitter and receiver mounted back to back.

1,412,545. SYSTEM OF CONTROL; Norman W. Storer, Pittsburgh, Pa. App. filed May 26, 1917. Regenerative control of electric vehicle motors.

1,412,546. MEANS FOR MINIMIZING COMMUTATOR FLASHOVERS; Norman W. Storer, Pittsburgh, Pa. App. filed Oct. 30, 1918. Discharge gap between terminals.

1,412,567. MEANS FOR AND METHOD OF WAVE TRANSMISSION; John Mills, Wyoming, N. J. App. filed Dec. 30, 1916. Reduces static interference.

1,412,570. ELECTRIC SWITCH; Herman G. Pape, New York, N. Y. App. filed Aug. 9, 1919. Pull socket for lamps.

1,412,572. MACHINE SWITCHING TELEPHONE SYSTEM; Lipa Polinkowsky, London, England. App. filed Dec. 6, 1918. Switching for combined manual and automatic system.

1,412,586. RECORDING SYSTEM; Horace H. Welch, Milwaukee, Wis. App. filed May 2, 1919. For measuring, recording, and integrating pressures, temperature, etc.

1,412,589. ELECTRIC CONTROLLING SYSTEM; Thorsten Zweigbergk, London, England. App. filed March 16, 1920. Main motor-driven controller actuated by master controller.

1,412,636. MOTOR CONTROL; John F. Tritle, Schenectady, N. Y. App. filed June 6, 1919. Acceleration of motor by automatic relays.

1,412,644. COMBINED SOCKET-COVER AND LAMP-RING LIGHT FIXTURE; Robert S. Aspinwall, Detroit, Mich. App. filed March 30, 1921.

1,412,726. INFLUENCE ELECTRICAL MACHINE; Louis Vogel, Strasbourg, France. App. filed June 28, 1921. Static machine for therapeutic treatment.

1,412,734. TELEPHONE SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. App. filed Jan. 30, 1917. Switching relays replaced by magnets on automatic system.

1,412,735. ELECTRIC HEATING DEVICE; Simon Halle, Arlington, Md. App. filed Dec. 26, 1918. Open circuits at predetermined temperatures.

1,412,748. ELECTRICAL CEILING FITTING CONNECTION; John A. McKay, Toronto, Ont., Can. App. filed July 1, 1918. Terminal block.

1,412,759. CEMENTLESS STRAIN INSULATOR; Frank J. Stevens, Rochester, N. Y. App. filed June 18, 1917. Successive disk held by clamping device.

1,412,764. ELECTRIC FURNACE; Arvid Westerberg, Djursholm, Sweden. App. filed Nov. 17, 1915. Design of choke coils to limit fluctuations.

1,412,776. MAGNETIC CHUCK; Oswald Coradi and Henri Graf-Buchler, Zurich, Switzerland. App. filed July 8, 1920. Magnets extend entirely across surface of chuck.

1,412,782. STATIONARY INDUCTION APPARATUS; William O. Dwyer, Pittsfield, Mass. App. filed Jan. 26, 1921. Construction of transformers to eliminate harmonics.

1,412,791. ELECTRICAL MEASURING INSTRUMENT; John H. Miller, Wilkinsburg, Pa. App. filed Oct. 13, 1917. Printing demand meter.

1,412,792. ELECTRICAL IGNITION MACHINE; Knut H. Morck, Buffalo, N. Y. App. filed Jan. 4, 1919. Automobile magneto.

1,412,817. REACTOR AND THE LIKE; Friend H. Kierstead, Pittsfield, Mass. App. filed March 27, 1920. Reactor and protective device combined.

(Issued April 18, 1922)

1,412,827. STEAM TURBINE; Karl Baumann, Urmston, England. App. filed Feb. 28, 1919. Supporting feet of turbine act as ventilating ducts to alternator.

1,412,853. SYNCHRONIZING SYSTEM; Lloyd Espenschied, Hollis, N. Y. App. filed Sept. 30, 1919. For two independent generating stations by carrier current.

1,412,908. SYNCHRONIZING SYSTEM; Karl S. Van Dyke, Chicago, Ill. App. filed June 10, 1920. For two independent generating stations by carrier current.

1,412,909. ELECTROLYSIS SUSPENSION HOOK; Edmund Voigt, Chicago, Ill. App. filed April 22,1921.

1,412,933. AUTOMATIC FLUX CONTROL FOR IGNITION SYSTEM; Hayner H. Gordon, Washington, D. C. App. filed Nov. 20, 1917. High-tension magnetos.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BANGOR, ME. — The Penobscot River Company, recently organized, contemplates the construction of a hydro-electric plant on the Rockabema River, in the vicinity of Howland. The project will include a transmission and distributing system.

BRATTLEBORO, VT.—The Village Commissioners are considering establishing a municipal electric distributing system for street lighting. It is proposed to secure electricity from the Vernon station of the Connecticut River Power Company.

ST. ALBANS, VT.—The Public Electric Light Company has applied to the Public Service Commission for permission to build a hydro-electric plant on the Lamoille River.

ST. JOHNSBURY, VT.—The Twin State Gas & Electric Company is considering the erection of a transmission line from St. Johnsbury to Gorham, N. H.

BRISTOL, N. H.—The Bristol Electric Light Company has petitioned the Public Service Commission for permission to extend its service into Hebron.

TURNER FALLS, MASS.—The Turner Falls Power & Electric Company has applied to the Department of Public Utilities for permission to issue $3,000,000 in bonds, part of the proceeds to be used for new construction.

Middle Atlantic States

BUFFALO, N. Y.—An appropriation of $60,000 has been approved for replacing all gas lamps with electric lamps in the parks and parkways.

CROTON FALLS, N. Y.—George Juengst & Sons, owners of the local electric light plant, are installing a 200-hp. Worthington oil engine and a 160-kw. General Electric generator. George Juengst, Jr., is manager.

DOWNSVILLE, N. Y.—The Holmes Milling Company expects to install street lamps during the coming summer.

NEWFANE, N. Y.—The Newfane Electric Company has increased its capital stock from $20,000 to $100,000 for proposed expansions.

POUGHKEEPSIE, N. Y.—Plans are under way by the United Hudson Electric Company for the construction of a second power unit of about 20,000 hp. capacity at Rifton, to cost about $400,000; also for the erection of a transmission line from Catskill to Ravena to connect with its system into Poughkeepsie and other territory it serves.

ALLENTOWN, PA. — The Pennsylvania Power & Light Company has contracted to supply power to operate the Wyoming Valley traction lines. Service will be furnished from the Harwood station.

HARRISBURG, PA. — Plans are being prepared for an underground conduit system in the uptown and hill sections for the municipal fire and police alarm system. Clark E. Diehl is city electrician.

HARRISBURG, PA.—The Lighting Department is preparing plans for the installation of incandescent street lamps in the section bounded by Front, Sixteenth, Market and Paxton Streets, to replace the present arc lamps. S. F. Hassler, city commissioner, in charge.

HARRISBURG, PA.—The Boad of Education will soon take bids for the erection of a central power plant for school service at Third and Division Streets, to cost $150,000. C. Howard Lloyd, Telegraph Building, is engineer.

HUMMELSTOWN, PA.—The Council has appointed a committee to obtain estimates of cost for a municipal electric power plant.

PHILADELPHIA, PA.—A power plant will be installed in connection with the new fifteen-story hotel (Sylvania) to be erected at Juniper, Watts and Locust Streets, to cost about $3,000,000. LeRoy B. Rothschild, 1225 Sansom Street, is architect.

PITTSBURGH, PA.—Bids will be received by the Board of Education until May 16 for electric lamps and other supplies for the local schools. G. W. Gerwig is secretary.

READING, PA.—The Metropolitan Edison Company will construct a transmission line from its power house at West Reading to the plant of the Pennsylvania Edison Company, Easton, to cost about $500,000. Transmission lines will also be built to connect with the system of the York Haven Water & Power Company, recently acquired.

TITUSVILLE, PA.—The Titusville Light & Power Company contemplates the erection of a 23,000-volt transmission line from Titusville to Oil City, a distance of 17 miles.

WILMINGTON, DEL.—The Department of Public Safety has approved plans for extensions to the conduit system for police and fire alarm lines.

BALTIMORE, MD.—The Board of Awards, City Hall, will receive bids until May 10 for 100,000 ft. of single vitrified clay conduit for the Electrical Commission.

BETTERTON, MD.—The Betterton Ice & Power Company contemplates the installation of another unit, consisting of a 20-kva. generator and a 25-hp. oil engine. Charles H. Brice is secretary.

HAGERSTOWN, MD. — The Louis H. Wiebel Company will rebuild its power house recently destroyed by fire.

SOUTH HILL, VA.—Bids will be received by the Town Council until May 10 for construction of waterworks, sanitary sewers and electric light plant, including the construction of power station, pole line and the purchase of the following machinery: Two 90-kva. generators directly connected to two "Unaflow" engines, one five-panel switchboard, two 100-hp. return tubular boilers, open feed-water heater, feed pump, one 50-gal.-per-minute deep-well pump and motor, two 750-gal.-per-minue simple duplex pumps, etc. The J. B. McCrary Engineering Corporation, Atlanta, Ga., is engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until May 9, for one 25-kw., 60-cycle transformer for the local navy yard. (Schedule 9599.)

North Central States

LANSING, MICH.—Work is now under way on the new 10,000-kw. municipal electric light plant. The building is designed for an ultimate capacity of 55,000 kw. W. B. Kirby is secretary of board of commissioners.

ROGERS, MICH.—The Consumers' Power Company, Jackson, has work under way on the rebuilding of its two-story power plant, recently destroyed by fire. The new station with machinery will cost about $400,000.

AKRON, OHIO. — The Northern Ohio Traction & Light Company will make extensions in its transmission and distribution lines and underground conduit system, to cost about $175,000. Plans are under consideration for power-plant extensions, etc., to cost, including the above work, about $1,000,000.

BUCYRUS, OHIO.—The Western Power Company, recently incorporated, will build a transmission line from Bucyrus to Newark. Amos Keller is secretary.

DAYTON, OHIO.—The Dayton Power & Light Company contemplates extensive additions to its system, including the installation of new boilers and a 27,000-hp. steam turbine and the erection of a 330-ft. smokestack at the Millers Ford plant; also to enlarge and double the output at the West Side substation, at a cost of $150,000. The total cost is estimated at $2,000,000.

KANSAS, OHIO.—A company has been organized by Lewis Jones and John Greiger, both of Kansas, to construct and operate a local light and power plant.

LIMA, OHIO.—Extensions to the boulevard lighting systems is under consideration. George L. Kirk is chief engineer of the municipal electric light plant.

PAYNE, OHIO.—The municipal electric light plant has been purchased by Cyrus Schumacher. The new owner is changing the system from direct to alternating current and is rebuilding the transmission lines. Electricity for operating the system is furnished by the North Western Ohio Light Company.

WARREN, OHIO.—The Ohio Public Service Company is preparing plans for the construction of a 132,000-volt transmission line from Warren to Alliance and Massillan.

MEXICO, IND. — The Mexico Electric Company will install a new 30-hp. water turbine this year. C. H. Black is owner and manager.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company has increased its capital from $300,000 to $400,000 for extensions and improvements.

PARAGON, IND.—Bids will be received by C. M. Bowman, town clerk, until May 31 for the installation of an outdoor-type substation and distributing system.

VEEDERSBURG, IND.—The installation of a new motor-driven 500-gal. per-minute rotary pump is under consideration by the Light and Water Commission. C. H. Bish is superintendent.

ALBION, ILL.—The Albion Electric Company is extending its transmission lines to Browns, 4 miles east, and to Bone Gap, 6 miles northeast of Albion. Cale Gough is president and manager.

ALVIN, ILL.—The Alvin Grain & Electric Company is planning line extensions into rural districts. Frank E. Yeazel is president.

CHICAGO, ILL.—Extensive additions and improvements are contemplated by the Commonwealth Edison Company, including the installation of two 30,000-kw., 12,000-volt, 60-cycle turbo-generators, six new substations equipped with lighting and railway converters, transformers and storage batteries, and necessary extensions to transmission and distribution systems.

HINSDALE, ILL.—The Village Board is planning to change the municipal electric lighting system from 1,100 volts to 2,300 volts during the coming summer. George H. Williams is village clerk. Through error this item appeared under Hinsdale, Mich., in the issue of April 15.

KEWANEE, ILL.—A special election will be held on June 5 to vote on a proposition to establish a municipal electric plant in Kewanee.

MILLSTADT, ILL.—New equipment will be installed in the municipal power plant, for which bonds have been voted.

RICHMOND, ILL.—The McHenry County Light & Power Company, operated by the Southern Wisconsin Electric Company, Lake Geneva, Wis., contemplates extending its transmission lines to furnish electrical service in Big Foot and Alden. Joseph Denison, Lake Geneva, Wis., is purchasing agent of the Southern Wisconsin company.

SIBLEY, ILL. — The installation of a storage-battery outfit in the municipal electric light plant is under consideration. W. R. Preston is clerk.

FLORENCE, WIS.—The erection of a transmission line to the Brule Settlement, a distance of 7½ miles, to furnish electricity to the farmers in that section from the municipal electric light plant is under consideration by the Water and Light Commission. O. Trempe is superintendent.

MARSHFIELD, WIS.—The boiler room of the municipal electric light plant is being enlarged and a 557-hp. Erie City boiler installed. A new 750-kva. electric generating unit will be installed some time this year. A. L. Brownell is superintendent.

TONY, WIS.—The Ashland (Wis.) Light & Power & Street Railway Company contemplates the construction of a hydro-electric plant on the Flambeau River, near Tony, to cost about $3,000,000, with transmission lines.

BAGLEY, MINN.—The Water and Light Commission contemplates the installation of a larger generating unit in the municipal electric light plant and erecting additional lines. G. M. Hanson is manager.

LAKEFIELD, MINN.—The installation of a new 150-kw. steam-driven generating unit in the municipal electric plant is under consideration. J. J. Hartneck is manager.

BATTLE CREEK, IOWA.—The Charles E. Churchill Electric Light, Heat & Power Company contemplates some improvements to its plant, including water softener, extra water-heating devices, etc. Charles E. Churchill is general manager.

DAVENPORT, IOWA.—The United Light & Railway Company will make extensions and improvements in its local distributing system, to cost $65,000.

DES MOINES, IOWA.—The Des Moines Electric Company has issued $958,000 in bonds, part of the proceeds to be used for extensions and improvements.

FORT DODGE, IOWA.—The Fort Dodge Gas & Electric Company has appropriated about $75,000 for extensions and improvements to its electric and gas systems.

GLIDDEN, IOWA. — The Hall Electric Company contemplates rebuilding and extending its system. C. H. Hall is purchasing agent.

MOUNT AYR, IOWA.—The Iowa Southern Utilities Company contemplates the installation of a 600-hp. boiler and a 4,000-kw. turbine. E. F. Bulman, Centerville, is manager.

ANNAPOLIS, MO.—The Annapolis Lead Company will build an addition to its power plant. M. C. Rhodes is president.

BOLIVAR, MO.—The Council is considering calling an election to submit the proposal to issue bonds for a new municipal electric plant to the voters.

JEFFERSON CITY, MO.—The State Capitol Commission has plans under way for

the installation of an ornamental lighting system on the Capitol grounds. Egerton Swartwout, 18 West Thirty-fourth Street, New York, is architect.

KIRKSVILLE, MO. — Plans have been drawn for extensions and improvements to the power plant at the Northeast Missouri State Teachers' College, including the installation of new equipment.

LINN, MO.—The Linn Electric Light Company is considering installing an oil engine, meters and establishing a twenty-four-hour service. G. W. Tainter is secretary.

MALTA BEND, MO. — J. E. Lunbeck, owner of the local electric light plant, is considering installing a smaller generating unit to handle a day load.

NEW MADRID, MO.—The installation of ½ mile of series street-lighting lines is under consideration by the Municipal Light and Power Commission. L. A. Richards is manager.

PATTONSBURG, MO.—The Pattonsburgh Light & Ice Company expects to make considerable line extensions and install additional power equipment. George E. Silver is president.

POPLAR BLUFF, MO.—The Iron Exploration Company will install a power house in connection with its proposed crushing, washing and screening plant.

ST. CHARLES, MO.—At an election held April 22 the proposal to issue $250,000 in bonds for the installation of a municipal electric lighting system and extensions to the municipal waterworks system was defeated. Carr Edwards is city engineer.

ST. JOSEPH, MO.—The National Biscuit Company will build an addition to the power house at its local plant.

ST. JOSEPH, MO.—At a recent election the proposition to issue $300,000 in bonds for an addition to the municipal electric plant was defeated.

WAVERLY, MO.—The Waverly Electric Light Company contemplates installing a steam-driven plant this fall and also some pole-line extensions. William C. Bartlett is owner and manager.

ARTHUR, N. D.—The Farmers' Elevator Company contemplates the installation of a new storage battery. J. A. Burgum is secretary and treasurer.

WHITE LAKE, S. D.—The White Lake Light & Power Company contemplates installing new equipment this year. W. J. Peters is owner and manager.

OAK, NEB.—The Meyer Hydro-Electric Power Company is making investigations relative to increasing its water-power capacity. Ernst Meyer is president and manager.

FOWLER, KAN.—A special election has been called to vote $18,000 in bonds, for the construction of a transmission line. J. O. Bevis is engineer.

Southern States

CONCORD, N. C. — The Locke Cotton Company will build a transmission line to connect its Locke and Buffalo mills.

OTEEN, N. C.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until May 16 for the installation of two electric passenger elevators in the United States Veterans' Hospital.

RALEIGH, N. C.—The Caroline Power & Light Company contemplates erecting a double-circuit steel-tower transmission line, designed to carry 75,000 hp., from Baden to Sanford, via Swift Island and Almans Ferry, to cost about $3,000,000. P. A. Tillery, Capitol Apartments, is general manager.

WILMINGTON, N. C.—The property of the Tidewater Power Company has been acquired by A. E. Fitkin & Company, 141 Broadway, New York. The new owner contemplates extensions and improvements to the system.

CHARLESTON, S. C. — A power plant will be installed in the new twelve-story hotel to be erected by the Francis Marion Hotel Company, to cost $1,200,000.

FORT VALLEY, GA. — A. J. Houser, owner of the local electric light plant, is considering the installation of a 120-kva. generating unit this fall.

ST. PETERSBURG, FLA.—At an election to be held May 13 the proposal to issue $300,000 in bonds for the construction of a municipal electric light plant will be submitted to the voters. C. T. Baker has been engaged as consulting engineer.

GREENVILLE, ALA.—The Council contemplates an ornamental lighting system on Commerce Street and other streets in the business section.

LUCEDALE, MISS.—The Lucedale Light & Power Company is contemplating installing an ice factory in connection with its electric plant. P. P. Bailey is manager.

SPRINGDALE, ARK. — The Springdale Light & Power Company contemplates erecting an 11-mile transmission line to furnish electricity to the Rogers (Ark.) Light & Water Company. V. McDaniel is treasurer and manager.

ALEXANDRIA, LA.—Plans are being prepared by the Louisiana Gravity Canal Company for five hydro-electric generating plants to be located at Lake Charles, Washington, Jennings and in the vicinity of Alexandria, with a total capacity of about 125,000 hp. The cost of the project is estimated at about $650,000. Welman Bradford is president.

MELVILLE, LA.—Plans are under consideration by the City Council for remodeling the municipal electric light plant, including the installation of new machinery, to cost about $35,000. The Swanson-McGraw Company, United Fruit Building, New Orleans, is engineer.

NEW ORLEANS, LA.—The United States Engineer Office, Custom House, La., will receive bids until May 11 for a turbo-generator, motor, switchboard, controllers, etc., for the United States pipe line dredge "Gulfport."

SHREVEPORT, LA.—The Lighting Commission is considering the installation of an ornamental lighting system on Milam Street. The plans call for seventy-two standards.

WINNSBORO, LA.—The Council is considering the installation of a municipal electric plant in connection with a new waterworks system, for which $80,000 in bonds have been voted.

CARTER, OKLA.—A special election will be held on May 9 to vote on the proposal to issue $23,500 in bonds for an electric substation and distributing system. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

HEAVENER, OKLA.—Jet condensers for both units will be installed in the municipal electric plant this fall. A transmission line will be erected to the town of Hodgens this summer. R. M. Edwards is manager.

RED ROCK, OKLA.—Bonds to the amount of $55,000 have been voted for the installation of an electric distributing system. Ray Purvis is city clerk.

SENTINEL, OKLA.—A new electric generating unit is being installed in the municipal light and water plant. About a mile of new transmission line will be erected to the new waterworks. L. W. King is manager.

WELEETKA, OKLA.—The Council has awarded a contract to the Ladd Construction Company, Scarritt Building, Kansas City, Mo., for a new transmission line, extensions and improvements in distributing system and electric pumping plant, to cost $72,000. Contract for power-house extensions, etc., will be awarded later. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CUERO, TEX.—The Cuero Light & Power Company contemplates extensions and improvements to its plant.

KILLEEN, TEX.—J. L. Bailey, Temple, Tex., owner of the local electric plant, contemplates improvements to the station, including the installation of new equipment.

LOCKHART, TEX.—The Citizens' Light & Water Company contemplates installing a 150-kw. generator. Arthur Seeliger is secretary.

PIONEER, TEX.—A franchise has been granted to J. A. Jackson, Pioneer, to construct and operate an electric plant here.

WACO, TEX.—The Texas Power & Light Company has tentative plans under way for the construction of a transmission line from Waco to Austin, about 108 miles. The company is reported to be negotiating for the municipal plant at Austin. If it is taken over, it will be enlarged to furnish service to the entire district.

Pacific and Mountain States

KALAMA, WASH.—The Oregon-Kalama Lumber Company, recently organized with a capital of $500,000, will equip its proposed new mill for electrical operation. W. D. Moreland is head.

SEATTLE, WASH. — The Puget Sound Power & Light Company has arranged for an issue of $1,100,000 in capital stock, part of the proceeds to be used for extensions and improvements.

SEATTLE, WASH.—Work is now under way on the first 48,000-hp. unit of the Skagit River development of the municipal electric system, to be finished in 1923, which includes the installation of two 24,000-hp. turbines, timber crib dam, rock tunnel, a 105-mile, 165,000-volt transmission line and a step-down substation in Seattle. J. D. Ross is superintendent.

TACOMA, WASH.—The City Council is considering the construction of two steam-electric plants for emergency service, to be located near the factories of the St. Paul & Tacoma Lumber Company and the Wheeler-Osgood Company, on the tide flats, which will also furnish power to these mills.

MILTON, ORE.—The Council has been granted permission to construct and operate a municipal power plant on the Walla Walla River.

CORNING, CAL.—W. H. Samson is organizing a company to construct and operate four hydro-electric power plants in Shasta County, with total capacity of 28,000 hp., to cost about $1,500,000.

DAVIS, CAL.—The Pacific Gas & Electric Company, San Francisco, will build a number of one-story buildings in Davis for general repair shops.

LOS ANGELES, CAL.—The Los Angeles Railway Company, Pacific Electric Building, preparing plans for a substation on Kingsley Drive, to cost $30,000.

LOS ANGELES, CAL.—Bids will be received by the Department of Public Service, Room 602, Public Service Building, until May 12 for lead-covered cables and accessories in accordance with Specification No. P-270. James P. Vroman is secretary.

OAKLAND, CAL.—Bids will be received by the Supervisors of Alameda County, Oakland, until May 15 for construction of power house and laundry building, etc., at the farm site of the Alameda County Hospital. G. Gross is county clerk.

ORANGE, CAL.—The Board of Trustees will install an ornamental lighting system on West Pine Street from East Chapman to East Palm Avenue. C. C. Bonebrake is city engineer.

PASADENA, CAL.—The City Directors have approved an ordinance for the installation of ornamental lamps. The plans provide for a total of seventy-three lamp standards. E. P. Dewey is city engineer.

SACRAMENTO, CAL.—Plans for the new hospital to be erected on L Street, near Twenty-eighth Street, by the Sutter Hospital Association, to cost $500,000, include a power house. Frederick H. Meyer, Bankers' Investment Building, San Francisco, is architect.

BOISE, IDAHO.—The Pacific Power & Light Company, Portland, Ore., has applied to the Federal Power Commission for permission to construct a hydro-electric plant on the Snake River, with ultimate capacity of 400,000 hp. A series of ten dams will be constructed for the water head.

GLENDIVE, MONT.—The Northern Pacific Railroad Company, St. Paul, contemplates the erection of a new power plant here, to cost about $50,000.

COLORADO SPRINGS, COL.—The Colorado Springs, Light, Heat & Power Company is preparing plans for extensions and improvements to its steam-driven electric plant.

Canada

FORT SASKATCHEWAN, ALTA.—Improvements are contemplated to the municipal electric light plant, including changing the system from two-phase to three-phase and respacing overhead lines from 24-in. centers to 36 in. to conform to the new Alberta rules. E. Barnott is superintendent.

NELSON, B. C.—The City Council is considering extending a 12,000-volt, three-phase transmission line 10 miles to furnish electricity to small settlements, farmers and fruit ranches. G. T. McGuire is manager of the municipal electric light plant.

WINNIPEG, MAN.—Bids will be received by the Committee on Public Utilities until May 15 for three 1,000-kva. transformers for the city power plant, Rover Avenue.

BROCKVILLE, ONT.—The Hydro-Electric Power Commission of Ontario has begun work on the erection of a new transmission line on the St. Lawrence system between Morrisburg and Brockville.

NIAGARA FALLS, ONT.—The Municipal Hydro-Electric Commission has awarded contract for a new substation to the Robertson Construction Company, Niagara Falls, to cost about $67,190.

PAISLEY, ONT.—The erection of a transmission line from Chesley to Paisley to supply electricity from the system of the Hydro-Electric Power Commission of Ontario in Paisley is under consideration.

WINDSOR, ONT.—The transportation committee of the City Council has recommended that Ontario Hydro-Electric Power Commission be requested to erect an auxiliary steam power plant in Windsor.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ASSOCIATION OF OPERATING ENGINEERS. Secretary, H. C. Bristol, Calderwood, Tenn.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 143 Liberty St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Niagara Falls, Ontario, June 26-30.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting, Atlantic City, N. J., June 26 to July 1.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City. Annual meeting, Spring Lake Beach, N. J., June 19-25.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual meeting, Cleveland, Ohio, Sept. 11-15.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

BRITISH COLUMBIA ELECTRICAL CO-OPERATIVE ASSOCIATION. Field manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada. Annual convention, Ottawa, June 15-17.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

ELECTRIC POWER CLUB. Executive secretary, S. N. Clarkson, 506 Laclede Gas Building, St. Louis, Mo. Annual meeting, Hot Springs, Va., June 5-7.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

ELECTRICAL SAFETY CONFERENCE. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Hot Springs, Va., May 24-26.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 165 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Daytona, May 15-16.

GREAT LAKES GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto. Annual meeting, Boston, Sept. 25-28.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Convention, New Bedford, Mass., Aug. 22-25.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa. Annual meeting, Lake Okoboji, Iowa, June 20-22.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer T. T. Parker, Kansas Electric Utilities Co., Emporia, Kan.

KENTUCKY ASSOCIATION OF PUBLIC UTILITIES. Secretary, E. F. Kelly, Louisville Railway, Louisville, Ky.

MICHIGAN ELECTRIC LIGHT ASSOCIATION. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

MIDDLE WEST DIVISION, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

NATIONAL COUNCIL LIGHTING FIXTURE MANUFACTURERS. Secretary, Chas. H. Hofrichter, 23 Gordon Square Bldg., West 65th St. and Detroit Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITY COMMISSIONERS. Secretary, James B. Walker, New York Transit Commission, New York City.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City. Convention, Atlantic City, May 15-20.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, James A. Loring, 161 Devonshire St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, New London, Conn., Sept. 5-7.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, W. J. Kreger, 47 West 34th St., New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL ELECTRIC ASSOCIATION, GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual meeting, St. Paul, Minn., June 13-15.

NORTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho. Annual meeting, Boise, Idaho, June 7-10.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, Ohio, July 11-14.

OKLAHOMA UTILITIES ASSOCIATION. Acting secretary, O. D. Hall, Oklahoma City.

ONTARIO ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, J. A. McKay, 24 Adelaide St. West, Toronto, Ont.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal. Annual meeting, Los Angeles, May 31-June 3.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, A. Bliss McCrum, Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, Renville H. McMann, 150 Nassau St., New York City.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Assistant to the president, W. L. Goodwin; secretary, Theo. E. Burger, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November; executive committee meetings every sixty days.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, 1106 First National Bank Bldg., Oklahoma City, Okla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. N. Willis, 403-4 Slaugher Bldg., Dallas, Tex.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. E. Warsaw, Burlington, Vermont.

WEST VIRGINIA-KENTUCKY ASSOCIATION OF MINE, MECHANICAL AND ELECTRICAL ENGINEERS. Secretary-treasurer, Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington, W. Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN UTILITIES ASSOCIATION. Executive secretary, John S. Cadby, Madison, Wis.

WYOMING UTILITIES ASSOCIATION. Secretary, C. Luscombe, Western Light & Power Co., Boulder, Col.

Directory of Electrical Associations

Printed in the First Issue of Each Month